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A COMPLETE HANDBOOK

FOR THE

SANITARY TROOPS

OF THE

U. S. ARMY AND NAVY

AND

NATIONAL GUARD AND NAVAL MILITIA

BY

CHARLES FIELD MASON

Colonel Medical Corps, U. S. Army

FOURTH EDITION, REVISED

Approved by the Surgeon-Generals of the Army and Navy

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PREFACE TO THE SECOND EDITION

In presenting the second edition of this handbook the author desires to say that every page has been carefully examined, corrected, and brought up to date. Many of the parts have been entirely rewritten and numerous new and improved illustrations inserted. The general size, plan, and scope of the work remain, however, unchanged.

CHARLES FIELD MASON.

WASHINGTON, January 31, 1909.

PREFACE TO THE FOURTH EDITION

In this edition it has been deemed advisable to omit the part on drill regulations for sanitary troops, and to considerably expand those on nursing, and those on pharmacy.

The appearance of a revision of Army Regulations and of the Manual Medical Department since the last edition of this book was brought out, has required a complete rewriting of those parts, while all the chapters have been carefully revised, corrected and brought up to date.

CHARLES FIELD MASON.

WASHINGTON, December 1, 1916.

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A COMPLETE HANDBOOK

FOR THE

SANITARY TROOPS

OF THE

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PART I

SANITARY TROOPS IN POST AND FIELD.

CHAPTER I

THE SANITARY TROOPS IN POST

THE Medical Department consists of one Surgeon General, chief of said department, a Medical Corps, a Medical Reserve Corps temporarily, a Dental Corps, a Veterinary Corps, an enlisted force (Sanitary Troops), the Nurse Corps and contract surgeons.

The enlisted force of the Medical Department consists of the following personnel: Master hospital sergeants, hospital sergeants, sergeants (first-class), sergeants, corporals, cooks, horseshoers, saddlers, farriers, mechanics, privates (first-class), and privates. Master hospital sergeants are appointed by the Secretary of War, but no person can be appointed master hospital sergeant until he shall have passed a satisfactory examination under such regulations as the Secretary of War may prescribe before a board of one or more medical officers as to his qualifications for the position, including knowledge of pharmacy, and demonstrated his fitness therefor by service of not less than twelve months as hospital sergeant or sergeant, first class, Medical Department, or as sergeant, first class, in the Hospital Corps; and no person may be designated for such examination except by written authority of the Surgeon General. Original enlistments for the Medical Department are made in the grade of private, and reënlistments and promotions of enlisted men therein, except as hereinbefore prescribed, and transfers thereto from the enlisted force of the line or other staff departments and corps of the Army are governed by such regulations as the Secretary of War may prescribe. The total number of enlisted men in the Medical Department should be approximately equal to, but not exceed, except as hereinafter provided, the equivalent of five per centum

of the total enlisted strength of the Army authorized from time to time by law but in time of actual or threatened hostilities, the Secretary of War is authorized to enlist or cause to be enlisted in the Medical Department such additional number of men as the service may require. The number of enlisted men in each of the several grades designated below may not exceed, except as hereinafter provided, the following percentages of the total authorized enlisted strength of the Medical Department, to wit: Master hospital sergeants, one-half of one per centum; hospital sergeants, one-half of one per centum; sergeants, first class, seven per centum; sergeants, eleven per centum; corporals five per centum; cooks, six per centum; privates, first class, forty-five per centum, and privates nine per centum. The number of horseshoers, saddlers, farriers, and mechanics may not exceed one to each authorized ambulance company or like organization.

Enlisted men may be transferred from the line to the medical department as privates Married men are not accepted as recruits, nor transferred from the line for service in the department Candidates for enlistment should apply to a post medical officer or to a recruiting officer. Applicants who have graduated in pharmacy, or who have had training as nurses in civil hospitals, should present certificates of their special qualifications. Slight physical defects which, under existing orders, would disqualify for the line, do not disqualify for enlistment in the department, provided they are not of such a character as would interfere with the full performance of the duties of a sanitary soldier in garrison or in the field. If a candidate is accepted he is forwarded to a company or detachment for instruction in: 1. Discipline and the duties of a soldier; 2. Care of animals and equitation; 3, Bearer drill and field work; 4, Anatomy and physiology; 5. First aid and personal and camp hygiene, including the sterilization of water and disinfection; 6. Nursing; 7. Army Regulations; 8. Cooking; 9. Materia medica and pharmacy; 10. Elementary hygiene; 11. Clerical work. All privates are instructed in the first six subjects, and those who show special aptitude take the complete course.

Instruction in the first three subjects is continuous throughout the year; the other subjects are included in the regular winter course of instruction covering a period of thirty-four weeks.

Field hospitals and ambulance companies maintained in time of

peace are also utilized so far as practicable in teaching recruits the work of the sanitary field organizations. The course of study taught recruits while with these organizations is supplemented by practical instruction at posts and in the field after their assignment to other commands.

The course for noncommissioned officers comprises the following subjects: Sanitary administration, pharmacy, clerical work, minor surgery, mess management and Army Regulations. Privates first class and privates who are candidates for appointment as noncommissioned officers are required to take this course; and in addition the regular course prescribed for their grades, or any part of it, if deemed necessary by the officer in charge of instruction.

Privates first class or privates who have shown special proficiency may be recommended for promotion by the surgeon. To test their capacity for performing the duties of a noncommissioned officer, they may be first detailed as lance corporals. Before being appointed sergeants they must pass an examination as to (1) Physical condition; (2) character and habits, especially as to the use of stimulants and narcotics; (3) discipline and control of men; (4) knowledge of regulations; (5) nursing; (6) dispensary work; (7) clerical work; (8) principles of cooking, and mess management; (9) Hospital Corps drill; (10) minor surgery and first aid, including extraction of teeth. The board will require the candidate to prepare a full set of papers pertaining to the medical department, and to drill a detachment sufficiently to demonstrate his thorough knowledge of the drill regulations.

The written examination will embrace the following subjects: (1) Arithmetic; (2) materia medica; (3) pharmacy; (4) care of sick and ward management; (5) minor surgery and first aid; (6) elementary hygiene. Ten questions will be asked in each subject. Proficiency in penmanship and orthography will be estimated from the papers submitted.

Sergeants who have served a year as such, or enlisted men of the hospital corps who served as hospital stewards of volunteers or acted in that capacity for more than six months during and since the Spanish-American war, may be appointed sergeants first class upon the recommendation of the Surgeon General, provided they have successfully passed a more extensive and detailed examination in the above subjects than is required for promotion to the grade of

sergeant. A reëxamination before his first reënlistment may not be required if his commanding officer and the department surgeon concur in the statement that the candidate has performed his duties efficiently; but a reëxamination is called for before a second reënlistment, after which no further examination is ordinarily required.

Army Regulations provide for at least one noncommissioned officer and four privates at each permanent military post, with an additional noncommissioned officer for every additional four privates; six privates when the garrison is two hundred, and two privates additional for every additional one hundred of strength.

The uniform for ordinary wear is the same as that of the line except that the facings are of maroon-colored cloth and that the caduceus is the emblem of the corps. Privates first class are distinguished from privates by wearing a caduceus upon the sleeves of the blouse above the elbow. For duty in the wards, kitchen, dispensary, and operating-room a uniform of white cotton duck is worn.

The duties of the sanitary troops in time of peace are chiefly concerned with the care of the sick, sanitation and preparation for war; that they are many, varied, and important may be gathered from the scope of the scheme of instruction detailed in the following pages.

The peace hospitals of the army are of three classes, *post hospitals*, *department hospitals*, and *general hospitals*; post and general hospitals are distinguished from each other by the fact that the former usually receive only the sick of the post to which they belong, while the general hospitals receive the sick from widely separated commands. Some of the general hospitals are of a special nature, such as that of Fort Bayard for the treatment of tuberculosis, and the general hospital at Hot Springs, Arkansas, for the treatment of cases requiring a course of bathing.

Department hospitals correspond in all respects to general hospitals except that they are under the control of the Department Commander.

The duties of noncommissioned officers of sanitary troops are to maintain discipline in hospitals and watch over their general police; to supervise the duties and assist in the instruction of the subordinate personnel in hospital and in the field; to look after and distribute hospital stores and supplies; to care for hospital prop-

erty; to compound medicines; to prepare reports and returns; and to perform such other duties as may, by proper authority, be required of them.

The senior noncommissioned officer must be an efficient disciplinarian, expert clerk, accurate arithmetician, and a trustworthy pharmacist, with as much knowledge of materia medica, therapeutics, and minor surgery as will enable him to give sound advice and suitable treatment in the minor ailments and accidents which in civil life are dependent on the resources of domestic medicine or the knowledge of the nearest pharmacist; in addition, he must have that higher knowledge, for use in the wards, which enables the experienced nurse to appreciate the condition of those who are seriously ill, that their improvement may be fostered and all harmful influences excluded. At small posts, during the temporary absence of the medical officer, the unforeseen casualties and even many of the exigencies of military life impose duties upon him the satisfactory performance of which may be of the first importance to the individuals concerned.

The following are official rules for the interior administration of hospitals:

(*a*) GENERAL RULES

(1) In the smaller hospitals the senior noncommissioned officer, under the direction of the surgeon, is in immediate charge of the hospital and the Hospital Corps detachment. He will see that all men of the detachment and all patients in the hospital are always present or accounted for. He will require all members of the detachment to perform their duties quietly and treat the sick with gentleness and consideration.[1]

(2) The noncommissioned officer in charge of public property will keep an accurate account of the same and its place of distribution.

(3) Each man in charge of a department of the hospital, as wardmaster, noncommissioned officer in charge of mess, etc., is responsible for the property used in his department. He will keep a list of the same and will by frequent inventories assure himself of its presence.

(4) All public property in the possession of the men must be kept in good order and all missing or damaged articles accounted for.

(5) A noncommissioned officer or other man, upon his assignment to a department of the hospital, will make himself familiar with the special orders governing it, and all must familiarize themselves with the standing orders of the hospital.

[1] In the larger hospitals it may be necessary to distribute these duties among several noncommissioned officers as determined by the commanding officer of the hospital.

(6) All noncommissioned officers and privates of the detachment will be present at all formations unless specially excused.

(7) All men on duty in the kitchen and mess room will arise at least one hour before reveille; all other members of the detachment, unless specifically excused, will arise at or before first call for reveille.

(8) Immediately after reveille each man will arrange his bed and personal belongings in a neat and orderly manner. All clean underclothing will be neatly folded and placed in the lockers, which will be uniformly packed; other clothing will be brushed and hung in the lockers or in a specially designated place. Soiled clothing will be kept in the barrack bags. Shoes will be polished and neatly arranged in the lockers or under the sides of the beds.

(9) All beds will be overhauled and cleaned each week and, weather permitting, the bedding and mattresses, together with the other clothing, will be well shaken and hung out to air for at least two hours. Mattress covers will be changed immediately before each monthly inspection or oftener if necessary. Sheets and pillowcases will be changed at least once each week.

(10) A card bearing the name of the soldier will be attached to the foot of his bed, and his accouterments will be hung, neatly and uniformly arranged, on the foot end iron of his bunk.

(11) The squad room will always be kept clean, neat, and orderly.

(12) The men will pay the utmost attention to personal cleanliness; each will bathe at least once weekly, his hair must be kept short, and his face shaved, or beard neatly trimmed, and his underclothing frequently changed. (See Army Regulations.)

(13) Members of the detachment will wear the prescribed uniform at all times when present at the post. While on fatigue they may wear the fatigue dress. While on duty in wards, dispensary, operating room, mess room, or kitchen, they will wear the white uniform.

(14) No member of the detachment will leave the hospital bounds except by permission of proper authority or, in case of emergency, in the execution of duty.

(15) Immediately after breakfast the hospital will be thoroughly policed in every department. It must be ready for inspection at the hour designated by the surgeon and always be kept absolutely clean.

(16) No member of the hospital personnel will borrow from or have financial dealings with any patient.

(17) When necessary a noncommissioned officer in charge of quarters will be detailed daily by roster from noncommissioned officers on duty with the detachment, and an emergency squad will always be designated.

(18) The noncommissioned officer in charge of quarters will make an inspection of all wards and quarters at such times as the surgeon may direct, will report all unauthorized absentees to the noncommissioned officer in charge of the detachment, and will see that no unauthorized lights are burning. In case of fire he will give the alarm and proceed as ordered in fire regulations. He will be responsible for the efficient performance of the watchman's duties.

(19) The night watchman, when one is necessary, will be under the immediate orders of the noncommissioned officer in charge of quarters. He

will patrol the hospital grounds at least once every three hours and will be constantly on the alert for fires, lights, and unauthorized persons in or about the hospital. He will at once report to the noncommissioned officer indicated all unusual occurrences and violations of existing orders which come under his observation.

(*b*) WARD RULES

(1) The wardmaster or each ward is directly responsible to the ward surgeon. He is in charge of his ward and the enlisted assistants and patients in it, and will be obeyed and respected accordingly.

(2) The wardmaster is responsible for the cleanliness and order of his ward, for the public property therein, and for the effects of his patients until they have been turned over to the proper custodian. He is responsible for the prompt delivery of prescriptions to the dispensary, of medicines to his ward, and of the diet orders to the hospital office.

(3) In wards to which members of the Nurse Corps are not assigned the wardmaster is responsible for the administration of medicines and other treatment prescribed, the keeping of records, and all other duties that may be assigned to him by the ward officer.

(4) Phenol, bichloride of mercury, other active poisons, alcohol, and alcoholic liquors, when necessarily on hand in the ward, will be kept under lock and key and every precaution taken to prevent their improper use.

(5) On the death of a patient the wardmaster will notify the ward surgeon, or in his absence the medical officer of the day. He will not remove the body from the ward until after it has been examined by a medical officer.

(6) The wardmaster will see that patients are acquainted with the ward rules.

(7) Before leaving the ward at the end of his daily tour of duty, the wardmaster will turn over to his relief all orders of the ward surgeon, accompanied by such explanation and instruction as may be necessary.

(8) Upon reaching the ward, patients will be promptly bathed, clothed in clean hospital clothing, and put to bed, unless their condition indicates otherwise or a specific order forbids.

(9) Money and valuables found on patients will be disposed of as prescribed in Manual Medical Department. The commanding officer will not be responsible for money or valuables of patients not turned over for deposit in the hospital safe.

(10) A clinical record will be carefully kept for each patient. Upon final disposition of the case this record will be completed and signed by the ward surgeon and turned in to the record office.

(11) No information regarding the diseases or condition of patients under treatment will be given to anyone except those authorized under the regulations to receive it.

(12) Visitors will be allowed to see friends in the ward at a specified time, when their presence will in no way disturb other patients; but female visitors will not be permitted in the wards except when cases are serious, and then only by special permission of the ward surgeon.

(13) Bed linen will be changed on occupied beds at least twice weekly, and oftener if necessary to insure cleanliness. Whenever a bed is to be occupied by a new patient clean linen will be furnished. All bedding and clothing used by infectious cases will be promptly disinfected when removed from the beds. Patients will not occupy their beds when dressed in other than hospital clothing.

(14) Loud noises, boisterous actions, the use of profane language, and gambling are forbidden in the wards, and no food, intoxicants, or other articles of food or drink, except as prescribed or authorized, will be brought into the wards.

(15) Patients are forbidden to use towels, basins, toilet articles, eating utensils, or articles of clothing pertaining to another patient.

ADMISSION AND DISTRIBUTION OF PATIENTS

Upon his admission to hospital a patient will first be taken to the receiving ward, if there is one, or to the office, where his register card will be filled in so far as the data are available at the time, the treatment ward to which he is assigned being noted on the back thereof. There will also be entered on a clinical record brief (Form 55*a*) the patient's name, rank, organization, etc., the diagnosis on the transfer card, if one has been received, and the designation of the ward to which he is assigned. This form will accompany the patient to the ward and will be the wardmaster's authority for his admission thereto.

Upon reaching the treatment ward the patient will be promptly stripped, bathed, clothed in clean hospital clothing and put to bed, unless his condition indicates otherwise or a specific order forbids.

The treatment sheet and the other clinical record sheets if required will be begun immediately upon the patient's admission.

The daily routine of the service of a post hospital begins at reveille, when, after roll call, the wards are tidied up and breakfast is served and cleared away before sick-call is sounded. Promptly on this call a noncommissioned officer from each company brings his sick to the place designated for their inspecaion; usually the hospital or a dispensary. A medical officer examines each man, indicating in the company sick report book those who are to be treated in hospital and those who are to be excused from duty or portions thereof as sick in quarters, etc. Morning reports are then sent to the adjutant's office for the information of the commanding officer. Prescriptions for those in quarters are now filled, and the register of sick and wounded is brought up to date by the careful entry of the morning's changes. After breakfast the wards are visited and the

prescription and diet orders recorded. After this the ktichen, dining-room, and other parts of the hospital are inspected, and the regulation visit is at an end. Emergency calls bring the medical officer to the hospital at any hour and generally, when serious cases are on hand, he may be expected before retreat or tattoo. After the morning visit he attends to his patients in the families of officers, married soldiers, laundresses, and other attachés of the garrison, and his prescriptions reach the dispensary from time to time during the forenoon. By the time these are filled the senior noncommissioned officer has posted the records, supplied the wards with needful articles of bedding, etc., given directions for the diet of the day, and provided the required supplies from his subsistence stores and special diet fund and hospital fund purchases. The afternoon may be devoted to instruction, exercises, or amusements, in the absence of special call for its occupation otherwise, and the evening to study, or, at certain periods, to the preparation of official reports and papers. The studies of the sanitary soldiers are naturally such as will fit them to act intelligently in all matters relating to the management of the hospital and the sick and wounded. Every medical officer supervises the instruction of his men and the higher education of his noncommissioned officers; the latter guide and perform similar offices to those who serve under them. The medical officer is required by regulations to devote at least five hours each week to instructing the men of the corps in their various duties. These duties will eventually lead every capable member of the corps to the position of a noncommissioned officer; but besides this personal influence they serve a higher end by preparing the corps for sudden expansion in time of war. When every sergeant is qualified to undertake the duties of the next higher grade, and every private qualified for the position of sergeant, the expansion of the command can be effected by merely recruiting for the lowest grade.

The senior medical officer is responsible for the timely and accurate rendition of the reports and papers required in the service of post hospital; but the work, except in the case of special and professional reports, is usually performed by enlisted men, to whom the clerical work has been assigned. For all routine reports blank forms are provided by the War Department, and full instructions are printed on each of these to insure accuracy, the said instructions having the force of Army Regulations.

CHAPTER II

THE SANITARY SOLDIER IN WAR

The duties of the sanitary soldier in war are even more varied and important than in time of peace and are apt to be more clearly defined. Thus some men will be assigned as litter-bearers, others as nurses, orderlies, cooks, operating-room assistants, etc. It is necessary that even privates should understand something of the field organization of the medical department.

ADMINISTRATIVE ZONES

In time of war the activities of the military establishment embrace:

(1) The service of the interior.

(2) The service of the theater of operations.

The service of the interior is carried on by:

(1) Department commanders.

(2) Bureau chiefs, having for this purpose general depots of supply, general hospitals, arsenals, etc.

(*a*) The service of the theater of operations is carried on by the commander of the field forces. The theater of operations is divided into two zones:

(1) The zone of the line of communications.

(2) The zone of the advance.

(*b*) The service of the interior functions both in peace and in war; that of the theater of operations in war only

OBJECTS OF MEDICAL DEPARTMENT ADMINISTRATION

The objects of Medical Department administration in war are:

(*a*) The preservation of the strength of the Army in the field by (1) the necessary sanitary measures; (2) the retention of effectives at the front, and the movement of noneffectives to the rear without obstructing military operations; and (3) the prompt succor of wounded on the battlefield and their removal to the rear, thus pre-

venting the unnecessary withdrawal of combatants from the firing line to accompany the wounded, and promoting the general morale of the troops.

(*b*) The care and treatment of the sick and injured in the zone of the advance, on the line of communications, and in home territory.

DUTIES OF THE MEDICAL DEPARTMENT

The Medical Department is charged with the administration of the sanitary service. Specifically, its duties are:

(*a*) The initiation of sanitary measures to insure the health of the troops.

(*b*) The direction and execution of all measures of public health among the inhabitants of occupied territory.

(*c*) The care of the sick and wounded on the march, in camp, on the battlefield, and after removal therefrom.

(*d*) The methodical disposition of the sick and wounded.

(*e*) The transportation of the sick and wounded.

(*f*) The establishment of hospitals and other formations necessary for the care of the sick and wounded.

(*g*) The supply of sanitary material necessary for the health of troops and for the care of the sick and wounded.

(*h*) The preparation and preservation of individual records of sickness and injury, in order that claims may be adjudicated with justice to the Government and to the individual.

PERSONNEL OF THE SANITARY SERVICE

General Enumeration

In time of war the sanitary service includes:

(1) All persons serving in or employed by the Medical Department, including officers and men temporarily or permanently detailed therein.

(2) Members of the American National Red Cross assigned to duty with the Medical Department by competent authority.

(3) Individuals whose voluntary service with the Medical Department is duly authorized.

(*a*) The personnel of the Medical Department and all other persons assigned to duty with that department are collectively called sanitary troops.

The following persons serve in or are employed by the Medical Department:

(1) Medical officers of the Regular Army (including officers of the Medical Reserve Corps), of the Organized Militia called into the service of the United States, and of the Volunteer Army.

(2) Physicians under contract.

(3) Members of the Dental Corps.

(4) Members of the Hospital Corps.

(5) Members of the Nurse Corps.

(6) Officers and soldiers of the line or staff detailed for duty with the Medical Department.

(7) Civilians employed by the Medical Department.

TITLES OF MEDICAL OFFICERS

The title of the senior medical officer on the staff of the commander of a field army is "chief surgeon"; of a line of communications, "surgeon, base group"; of a division, "division surgeon"; of a brigade operating independently, "brigade surgeon"; of a detachment, regiment, or smaller command, "the surgeon"; of a field hospital or other sanitary formation, and of an ambulance company or detachment thereof, "commanding officer.

INSIGNIA OF SANITARY PERSONNEL, FORMATIONS, AND MATERIAL

(See Rules of Land Warfare.)

In campaign, all persons belonging to the sanitary service and chaplains attached to the Army wear on the left arm a brassard bearing a red cross on a white ground, the emblem of the sanitary service of armies. This brassard is issued and stamped with a number by competent authority, and in case of persons who do not have military uniforms it is accompanied by a certificate of identity.

Brassards will be issued to the uniformed personnel of the sanitary service and to chaplains by the senior medical officer of the organization with which they are on duty. To other individuals entitled thereto under the provisions of the Geneva convention brassards and certificates of identity (Form 61) will be issued by the division surgeon, surgeon, base group, the department surgeon, or the Surgeon General, as the case may require. The certificate of identity will bear the same number as the brassard.

The person to whom a certificate of identity is issued will retain it in his personal possession and exhibit it when called upon by competent authority to do so. Care will be exercised to prevent the certificate of identity or its container from coming into the hands of another person. The loss of a brassard or of a certificate will be investigated and reported by the immediate commander to the office which issued the lost article.

All sanitary formations display during daylight (reveille to retreat) the Red Cross flag accompanied by the National flag. If a sanitary formation falls into the hands of the enemy it displays while in such situation the Red Cross flag only. At night the positions of sanitary formations are marked by green lanterns — a camp infirmary by one green lantern; a field hospital by two green lanterns, one above the other; and an ambulance company or its dressing station by one green lantern above one white lantern.

All matériel pertaining to the sanitary service is also marked with the Red Cross emblem, a red cross on a white ground.

STATUS OF SANITARY PERSONNEL AND MATERIAL

All the personnel of the sanitary troops and armed detachments or sentinels ordered by competent authority to guard sanitary formations are respected and protected under all circumstances. If they fall into the hands of the enemy, they do not become prisoners of war but are disposed of as provided in Article 12 of the Geneva convention, 1906. In order to obtain this protection, the commanding officer of every sanitary formation should require of his subordinates a strict observance of the terms of the Geneva convention.

ORGANIZATION OF THE MEDICAL DEPARTMENT IN WAR

The following table gives an outline of the organization of the Medical Department in war:

- Surgeon General
  - Service of the interior.
    - Department surgeons.
    - Medical service, mobilization camps.
    - Medical service, concentration camps.
    - Camp hospitals.
    - [illegible]al [illegible]tals.
    - [illegible]onvalesce[illegible] camps.
    - [illegible]ospitals, port[illegible] of embarkation.
    - Surgeons, po[illegible]ts [illegible]f embarkation.
    - Hospitals for prisoners of war.
    - Medical supply depots.
    - Hospital trains and trains for patients.
    - Rest stations.
    - Hospital ships and ships for patients.
    - Sanitary inspectors.
  - Theater of operations (chief surgeon, field army).
    - Zone of the advance (division surgeons).
      - Medical department personnel on duty with line organizations.
      - Sanitary trains.
        - Directors of ambulance companies. — Camp infirmaries. Ambulance companies.
        - Directors of field hospitals. — Field hospitals.
    - Zone of the line of communications (surgeon, base group).
      - Base section (surgeon, base group):
        - Base medical supply depot.
        - Base hospitals.
        - Convalescent camps.
        - Contagious disease hospitals.
        - Trains, boats, and ships.
        - Casual camps for sanitary troops.
        - Sanitary squads.
        - Field laboratories.
        - American National Red Cross units.
        - Sanitary inspectors.
      - Intermediate section (surgeon, intermediate group):
        - Rest stations.
        - American National Red Cross units.
      - Advance section (surgeon, advance group):
        - Advance medical supply depot.
        - Sanitary column. — Evacuation hospitals. Evacuation ambulance companies.

THE SERVICE OF THE INTERIOR

MOBILIZATION CAMPS

(See Army Regulations: Organized Militia.)

The places of assembly for Volunteers and for the Organized Militia of a State, Territory, or the District of Columbia when called into the service of the United States are known as mobilization camps.

CONCENTRATION CAMPS

(See F. S. R.: Service of the Interior.)

The places which are selected by the War Department, when war is imminent or has been declared, for the assembly of troops for joint operations or for embarkation, are known as concentration camps.

CAMP HOSPITALS

A camp hospital is an immobile unit organized and equipped for use in camps where the care of the sick would otherwise result in the immobilization of field hospitals or other sanitary formations pertaining to organizations.

HOSPITAL TRAINS AND TRAINS FOR PATIENTS

Hospital trains are Medical Department organizations and will be provided by the War Department when required for the transportation of the sick and wounded. In cases of emergency when hospital trains are not available ordinary trains for patients will be provided for the temporay use of the Medical Department.

A hospital train made up of 10 cars, of which 8 are for patients (capacity 200), is allowed, in accordance with Tables of Organization, a personnel of 3 medical officers (captains or lieutenants); 3 noncommissioned officers (1 sergeant first class, 2 sergeants); 2 acting cooks; 22 privates first class and privates (20 nurses, 2 orderlies).

REST STATIONS

Rest stations will be organized at points on the railway lines where attention can best be given to sick and wounded en route. So far

as possible the personnel of such stations will be obtained from the American National Red Cross.

HOSPITAL SHIPS AND SHIPS FOR PATIENTS

On over-sea expeditions hospital ships and ships for patients may both be required. They will be provided by the War Department.

Hospital ships are Medical Department organizations and will be used solely by that department. Ships for patients are ordinary transports or vessels turned over to the Medical Department for temporary use in emergencies when hospital ships are not available.

The personnel of a hospital ship (capacity 200 beds) consists of 5 medical officers (1 lieutenant colonel or major, 4 captains and lieutenants); 5 noncommissioned officers (1 sergeant first class, 4 sergeants); 5 acting cooks; 30 privates first class and privates (29 nurses, 1 orderly).

THE THEATER OF OPERATIONS

THE ZONE OF THE ADVANCE

The sanitary personnel of the zone of the advance may be divided into two general groups, as follows: First, that attached to line organizations smaller than a brigade, which functions under the immediate orders of the organization commanders; second, that comprising the sanitary trains, which functions under the orders of division surgeons in accordance with such general or specific instructions as they may receive from their division commanders.

(See also Field Service Regulations.)

Sanitary troops with line organizations, including detachments with regiments, battalions, trains, etc., vary in personnel with the strength of the organization served and the nature of the duties they are required to perform. (See Tables of Organization: *War — Regimental Organization.*)

When a regiment is operating independently the Medical Department equipment available for its use consists of the first-aid packet carried by each officer and enlisted man of the Army as a part of his individual equipment; the articles carried as individual equipment by each medical officer and by each enlisted man of the medical department; the combat equipment; the camp infirmary equipment;

and the additional articles necessary for the establishment of a regimental hospital.

(*a*) The additional articles for the regimental hospital will be taken to the field only under circumstances requiring the organization to provide hospital care for its own sick and wounded.

When a regiment or other line organization is operating as a part of a division the Medical Department equipment provided for its exclusive use consists of the first-aid packets and individual equipments mentioned in the preceding paragraph, and the combat equipment. A small box of surgical dressings and one or more litters are carried on each ammunition wagon. The requisite articles for the establishment of the aid station are carried on the pack mule allotted the sanitary service, which marches with the combat train of the organization. The medical officer responsible for this equipment will see that it is complete and that it is maintained intact for service in combat.

(*a*) On the march and in camp, with the exceptions noted in paragraph 601, M. M. D., the medical supplies and dispensary service required by regimental organizations are provided through the medium of the camp infirmary.

(*b*) In combat it is contemplated that the expenditures of dressings, etc., from the equipment of regimental organizations will be replenished from the reserve supplies of the nearest ambulance company or camp infirmary.

On the march the duties of the sanitary personnel are to render first aid where required, to transport the sick and wounded, and to make suitable disposition of them on arrival in camp

Ordinarily the surgeon marches with the regimental commander, and one medical officer marches in the rear of each battalion. Each officer is mounted and accompanied by a mounted orderly. The remaining regimental sanitary personnel usually march with the battalion units.

When out of the presence of the enemy, ambulances are ordinarily ordered distributed by the division commander throughout the column, in the rear of regiments, battalions, etc. Unless otherwise ordered these ambulances join their companies at the end of the day's march or at the beginning of an engagement. When a regiment operates independently it may be assigned its full quota of four ambulances.

A soldier falling out of the marching column from sickness or injury is sent to a medical officer in the rear, with a pass from his company commander, showing the soldier's name and organization. The medical officer returns the pass, showing the disposition made of the soldier. The man may be given authority to ride in the ambulance at the rear of the regiment, or his arms and personal equipment may be carried in the ambulance, and he may march at the rear of the regiment with the sanitary detachment.

When an ambulance at the rear of a regiment is filled it may fall out and join its company at the rear of the column, and the director of ambulance companies or the ambulance company commander may send forward another ambulance to take its place; or the ambulance may remain with the regiment, and men requiring transportation may be given diagnosis tags authorizing their transportation by the ambulance company in the rear. In the latter case the men fall out and report to the commander of the ambulance company for transportation.

The arms, personal equipment, and clothing of a soldier who falls out are taken with him in the ambulance. The horse, saber, and horse equipment of a soldier admitted to the ambulance or otherwise separated from his organization because of sickness or injury are taken back to the troops by the noncommissioned officer who accompanied him.

Upon halting for the night all but the trivial cases are taken in charge by a field hospital designated by the division surgeon, or they are sent to the rear, as the conditions may warrant. It may be necessary to leave them under shelter — in houses, if practicable — with the necessary food and attendants until taken in charge by sanitary troops from the line of communications.

In combat the duties devolving on the sanitary personnel are to render first aid to the wounded; to establish and operate an aid station, and to collect the wounded thereat; to direct those with trivial wounds to return to the line, and to direct others with slight wounds to the station for slightly wounded; and in exceptional cases to transport the severely wounded to the dressing station.

The detachment invariably accompanies its line unit in combat, rendering first aid to as many as possible of those who fall out, without losing touch with the command. It is assisted by the band if the latter is assigned to duty with the sanitary troops.

Unless medical assistance is available, the wounded apply their first-aid packets, if practicable. With this exception the care of the wounded devolves upon the sanitary troops, and no combatant, unless duly authorized is permitted to take or accompany the sick or wounded to the rear.

With dismounted troops the aid station, not more than one for each regiment or smaller independent unit, will be established as the engagement develops and the number of wounded warrant it, providing it is probable that the command will remain, for a short period at least, near the proposed location of the station. With a mounted command the sanitary detachment accompanies the troops during the whole course of the engagement, pausing only so long as is necessary to render first aid and to collect the wounded at some place where they can be turned over to an inhabitant of the country to be cared for. The commander of the advancing foot troops or of the advance section should be promptly notified of the location of the wounded thus collected.

In locating the aid station it is of the highest importance that advantage be taken of any shelter from fire which the terrain affords. To a large extent the distance of the station from the firing line must depend upon this consideration. It will be borne in mind that any building which offers a good target for artillery fire is worse than no shelter at all, and that the nearer the station is to the front the safer it will be from dropping projectiles.

The surgeon remains, as a rule, at the aid station, with a non-commissioned officer and the necessary number of privates, for to this station the commanding officer will send information or orders which he may have to communicate to the surgeon, and through this station the surgeon gains contact with the units of the sanitary train in the rear. The other medical officers and the remainder of the detachment keep in touch with the firing line, tending the wounded as far as possible and conveying the helpless to the station, if practicable. If the enemy's fire is such that the wounded can not reach the station advantage is taken of trenches, ravines, and other inequalities of the ground affording temporary shelter, and the wounded are brought in during intervals in the firing or after nightfall.

No one belonging to the sanitary personnel of an organization will go farther to the rear than the aid station, except by authority of the surgeon.

The aid station, which will often be but little more than a place for assembling the wounded, should not undertake elaborate or fixed arrangements for their care and treatment, as its personnel must keep in touch with the regiment and be prepared to close or move the station without delay when the regiment moves. The treatment given will usually be limited to first aid and to the readjustment of dressings. Occasionally it may become necessary to ligate an artery or to perform an emergency operation. Fractures, if not previously immobilized, should be put in splints. Diagnosis tags will be attached to all wounded and the duplicates disposed of as directed in paragraph 571 M. M. D. The arms and equipment of wounded separated from their companies and taken in charge by

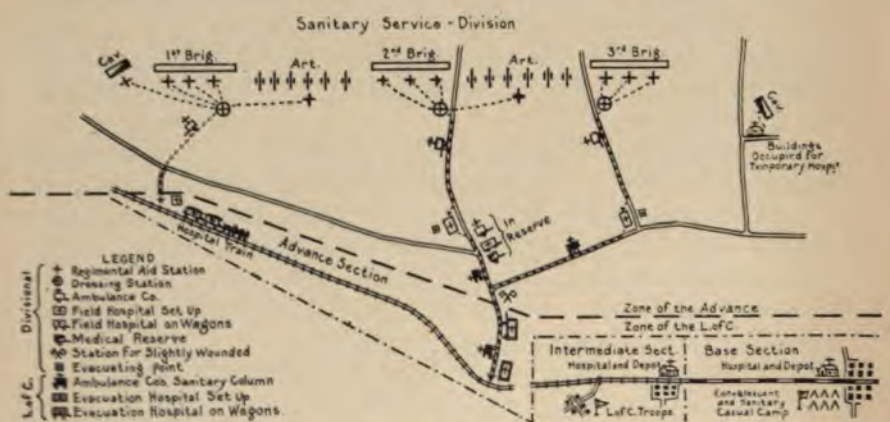

FIG. 1.— Sanitary Service. Zones of Administration.

the Medical Department should, so far as practicable, accompany them until they reach the line of communications.

In the course of battle the advance of troops may result in the aid station being separated so far from the line that it can no longer fulfill its purpose. In this case it must be advanced to a more favorable location. Ordinarily the wounded left behind will be looked after by the advancing ambulance company, but if it is apparent that this will be long delayed a small portion of the regimental personnel may be detailed to remain with them. Similar action will be taken in case of retreat. The closing or moving of the station rests on the decision of the regimental surgeon. In reaching his

decision he should be governed by the primary necessity of always keeping in touch with the regiment.

The sanitary train is composed of camp infirmaries, ambulance companies, and field hospitals. It is commanded by the division surgeon.

CAMP INFIRMARIES

Each regiment of a division has assigned to it in time of peace one camp infirmary equipment, including one wagon belonging to the divisional sanitary train. (See Tables of Organization: *Peace—Regimental Organizations:*)

When the division is assembled the camp infirmary equipments authorized for the service of the mobilized division (usually on the basis of one for each brigade) are retained for duty as camp infirmaries. The remaining camp infirmary equipments, except transportation, are turned in to the officer in charge of medical supplies and the wagons thus released are assigned to those units of the sanitary train for which no transportation is provided in time of peace.

THE AMBULANCE COMPANY

The personnel of an ambulance company at war strength, as given in Tables of Organization, are ordinarily distributed as follows:

(*a*) With the dressing station, including the litter bearers: 4 officers, 1 sergeant first class, 6 sergeants, 1 acting cook, 40 privates first class and privates, all of the Medical Department.

(*b*) With the wheeled transportation: 1 officer, 1 sergeant first class, 1 sergeant, 1 acting cook, 28 privates first class and privates (1 as farrier, 1 as saddler, 2 as musicians, 12 as ambulance drivers, and 12 as ambulance orderlies), all of the Medical Department; also 1 sergeant (blacksmith) and 3 privates (drivers) of the Quartermaster Corps.

The function of the ambulance company is to collect the sick and wounded, to afford them temporary care and treatment and to transport them to the next sanitary unit in the rear.

In camp the ambulance company operates an ambulance service between the camp infirmaries and the field or other hospitals.

On the march ambulances are distributed among the marching troops, usually one to each regiment, for the purpose of supplying transportation to those who become unable to march.

In combat the company operates in two parts. The first establishes and operates a dressing station and collects the wounded thereat, the second operates the wheeled transportation in evacuating the wounded.

Ambulances must reach the dressing station as early as possible even at the risk of losses. Ordinarily ambulances will carry wounded only from the dressing station to the nearest field hospital, immediately returning to the former; any other destination for wounded must be prescribed by the division surgeon.

THE FIELD HOSPITAL

(Capacity 216.)

The field hospitals will be numbered from 1 upward in a single consecutive series for the entire military establishment.

The wagons of the field hospital will be marked as prescribed in Tables of Organization.

The commanding officer of the field hospital is under the immediate orders of the director of field hospitals, when there is one; otherwise he is under the immediate orders of the division surgeon.

The personnel of a field hospital at war strength, as given in Tables of Organization, are ordinarily assigned as follows: 1 major (commanding); 5 captains and lieutenants (1 adjutant and quartermaster, 4 ward surgeons); 3 sergeants first class (1 acting first sergeant in general supervision of the hospital and in charge of medical property and records, 1 in charge of transportation and quartermaster property and records, 1 in charge of mess supplies and cooking); 6 sergeants (1 in charge of the dispensary, 1 in charge of operating equipment, 1 in charge of patients' clothing and effects, 3 in charge of wards); 3 acting cooks; 55 privates first class and privates (46 attendants, 1 dispensary assistant, 1 artificer, 4 orderlies, 3 supernumeraries); and of the Quartermaster Corps, 1 sergeant (wagon master) and 7 privates (drivers).

The function of the field hospitals is to keep in touch with the combatant organizations and to provide shelter and such care and treatment as are practicable for the sick and wounded of the division who are brought in by the ambulance companies until the sanitary service of the line of communications takes charge of them. A field hospital can meet these requirements only when it is relieved so promptly by the sanitary units in the rear that its mobility is not

interfered with. Prompt evacuation of the sick and wounded is necessary also to secure for them the facilities for treatment and the comforts which are available on the line of communications.

On the march and in temporary camps, however, the field hospitals are the nightly collecting points for the divisional sick and injured who are unable to continue the march, and must provide for the care of such patients until they can be turned over to the medical service of the line of communications or to a local hospital or hospitals. The use of the field hospitals for this purpose should be carefully regulated by the division surgeon.

(*a*) So far as practicable in each division only one field hospital at a time will be used in this service, leaving the others entirely free of patients. Furthermore, only so much of the equipment of the field hospital assigned to this work should be unpacked as is required to care properly for the patients actually in the hospital and their necessary attendants who are to remain behind when the division moves on. The number of personnel detailed to remain will be as small as possible.

(*b*) The equipment which has not been unpacked and the personnel who have not been detailed to remain with the patients will move with the division.

(*c*) Every effort will be made by the division surgeon to dispose of the patients left behind. Should unusual delay in turning them over to the medical service of the line of communications supervene, temporary provision for them should be arranged in civil hospitals of the locality or otherwise as may be most practicable until the medical units of the line of communications can take charge of them.

(*d*) As soon as the patients are disposed of, the personnel detailed for the temporary care of such patients will immediately rejoin the hospital.

On the receipt of an order to open a field hospital the following departments will be established:

Dispensary.
Kitchen.
Receiving and forwarding.
Slightly wounded.
Seriously wounded.
Operating room.
Mortuary.

All wounded arriving at the field hospital will be received at the receiving and forwarding department, which is the administrative office of the hospital.

(*a*) The slightly wounded, able to walk, will be immediately directed to the rear or to the station for slightly wounded, as the circumstances may indicate.

(*b*) The seriously wounded, and the slightly wounded unable to walk, will be assigned to the proper department for treatment.

(*c*) Records of the wounded will be made as prescribed in paragraph 575 et seq M. M. D.

THE STATION FOR SLIGHTLY WOUNDED

The station for slightly wounded is a transient divisional organization on the battle field; it has no permanent personnel or definitely prescribed equipment.

(*a*) The personnel required for the station, usually one medical officer, two noncommissioned officers, and eight privates, will be detached from such unit of the sanitary train as the division surgeon may elect. In some instances it may be practicable to utilize personnel sent forward from the line of communications.

(*b*) For the equipment of the station one of the camp infirmaries of the division may be utilized, or a medical and surgical chest and such other supplies as are necessary may be temporarily detached from one of the field hospitals.

The functions of the station for slightly wounded are (1) to afford a place where men who are unable to accompany their units into combat may be assembled; (2) to relieve dressing stations and field hospitals of the congestion incident to the presence of the slightly wounded who can walk and who require but little attention.

The station, usually one for each division, is established when combat is imminent. It should be about the same distance from the firing line as the field hospitals. A building should be selected for its use when practicable. It should preferably be located on the route over which the troops have advanced, as this route is the one which the disabled are most likely to follow in working their way to the rear. In any case it should be so conspicuously marked that it can be found readily.

Extensive preparations at this station are unnecessary. A tent

should be erected, if no building is available, where dressings may be applied or readjusted and arrangements made for the preparation of simple nourishment. Diagnosis tags should be attached to all wounded not already tagged. The duplicates of the tags will be disposed of as directed in paragraph 571 M. M D. A list of sick and wounded will be prepared as prescribed in paragraph 580 M. M. D.

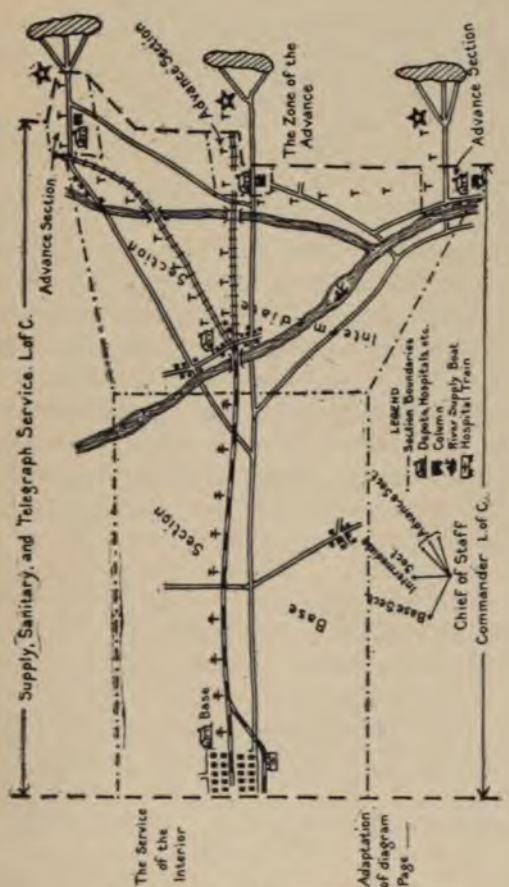

FIG. 2.—Line of Communications.

THE LINE OF COMMUNICATIONS

The line of communications is the connecting link between the service of the interior and the zone of the advance. It is estab-

[illegible] when an important force is about to engage in field operations involving a movement from a base unless the territory through which the supply services extend can be safely occupied without military operations of an extensive character. In the latter case administration and supply are accomplished as in the service of the interior.

The line of communications is ordinarily divided into a base section and an advance section. In certain cases, due to prolongation of the line of communications, an intermediate section may be required. An advance section is required at the head of each important route of supply diverging from the base.

The mission of the sanitary service of the line of communications is (1) to provide such adequate facilities for the treatment of the sick and wounded that those not permanently disabled may be returned to the front with the least practicable delay; (2) to furnish such an efficient evacuation service as will promptly relieve the fighting forces of the encumbrance of their sick and wounded and allow the sanitary units in the zone of the advance to maintain contact with their combatant organizations; (3) to organize and maintain a system of supply that will enable the sanitary troops in the theatre of operations to replenish their equipment and supplies by direct methods and without delay; (4) to maintain satisfactory sanitary conditions among the troops on the line of communications and, if necessary, to take entire charge of sanitation among the inhabitants of the occupied territory.

The Medical Department units pertaining to the line of communications are the following:

Base group.—A medical supply depot, one or more base hospitals, and, when required, convalescent camps, contagious disease hospitals, hospital trains and trains for patients, hospital ships and ships for patients, casual camps, sanitary squads, field laboratories, and organizations of the American National Red Cross.

Intermediate group. Rest stations, organizations of the American National Red Cross, and such other sanitary formations as may be necessary.

Advance group. Two evacuation hospitals and one evacuation ambulance company for each division at the front supplied from the advance section, and an advance medical supply depot. The evacuation hospitals and evacuation ambulance companies of the advance section are collectively known as the sanitary column.

THE BASE HOSPITAL

(Capacity 500.)

Base hospitals are Medical Department units of the line of communications under the supervision of the surgeon, base group. They will occupy buildings, if suitable ones are available.

THE CONVALESCENT CAMP

In appropriate cases convalescent camps may be established in the vicinity of base hospitals. Such camps will be branches of the base hospital near which they are situated.

THE CONTAGIOUS DISEASE HOSPITAL

Ordinarily cases of infectious disease occurring among troops in the theatre of operations will be cared for in the isolation wards of base or other hospitals and so far as practicable at or near the place of origin of the disease. In the presence of a serious epidemic, however, special facilities for the isolation of cases may be required. In this event the surgeon, base group, with the authority of the commander of the line of communications, will organize such contagious disease hospitals as may be necessary to meet the emergency.

TRAINS, BOATS, AND SHIPS

The general regulations governing the organization, personnel, matériel and operation of hospital trains, trains for patients, hospital ships, and ships for patients in the service of the interior will apply also to the similar medical department units on the line of communications, except that the duties performed by the Surgeon General with respect to the former will devolve in the latter case upon the surgeon, base group.

SANITARY SQUADS

For the purpose of giving attention to sanitary matters not within the control of regimental or other military organizations, sanitary squads will be organized on the line of communications at such places as may be necessary.

The personnel of such squads will consist of enlisted men of the Hospital Corps augmented by such number of other enlisted men

and civilian laborers as the amount and character of the work may justify. Each squad will be in immediate charge of a medical officer.

The function of sanitary squads is to supervise or execute, as the case may be: (1) The necessary measures for the sanitation of camp sites, towns or villages not occupied or garrisoned, or of such parts of the same as may be otherwise unprovided for; (2) sanitary work that may be necessary for the general welfare but that can not be performed conveniently or profitably by individual organizations; (3) the operation of sanitary apparatus used by troops in common and not under control of any one organization.

Sanitary squads will not be employed to relieve regimental and other similar organizations of the duty of providing for the sanitation of their own camps.

REST STATIONS

Rest stations are organized for the purpose of giving temporary care and treatment to sick and wounded en route. When on railway lines those established on the line of communications are similar in every way to those pertaining to the service of the interior and their personnel should, if practicable be obtained in like manner.

THE BASE MEDICAL SUPPLY DEPOT

A medical supply depot will be established at the base. The officer in charge of this depot will prepare in quadruplicate a list of all supplies required, showing the maximum and minimum quantities of each article which should be kept on hand in the depot, having due regard in formulating this estimate to the number of troops to be supplied, the time required by the depot to replenish supplies, the character of the military operations in prospect, etc. In stating the minimum quantity of supplies the supply officer should include at least one medical reserve unit for each division at the front, in addition to the supplies likely to be required by the sanitary formations on the line of communications. Three copies of the above-mentioned list will be forwarded through military channels to the commander of the military forces. When approved, one copy will be retained at the headquarters of the commander of the field forces, one copy will be sent to the Surgeon General, and one copy will be returned to the officer in charge of the depot.

THE ADVANCE MEDICAL SUPPLY DEPOT

The stock on hand at this depot will be considered a part of the available supply of the base depot, as far as the table fixing the maximum and minimum stock limits is concerned.

THE EVACUATION HOSPITAL

(Capacity 432.)

The evacuation hospitals are Medical Department units belonging to the line of communications. Ordinarily two evacuation hospitals will be assigned to a line of communications for each division which it serves in the zone of the advance. They will be numbered and designated like the base hospitals.

The primary function of the evacuation hospital is to replace field hospitals so that the latter may move with their divisions, or to take over their patients with the same object in view. So far as it

THE EVACUATION AMBULANCE COMPANY

Evacuation ambulance companies are organized only in time of war or when war is imminent. They are allowed in the proportion of one for each division at the front. They will be numbered consecutively from 1 upward for each field army to which they belong, as "Evacuation Ambulance Company No. 1, 3rd Field Army."

The primary function of the evacuation ambulance company is the evacuation of field hospitals and the transportation and care of patients en route therefrom to evacuation, base, or other hospitals on the line of communications or to points with train or boat connections for rail or water transport to such hospitals.

ADMINISTRATION

For administration and control the line of communications is organized as follows:

(1) A service of defense.

(2) A supply, sanitary, and telegraph service.

(3) A service of military railways.

All personnel pertaining to the sanitary service of the line of communications report at the base for assignment to duty. Here advance and intermediate sections are organized and sent forward as required.

RÉSUMÉ OF THE OPERATIONS OF THE SANITARY SERVICE IN WAR

When war is imminent, the Regular Army is moblized at its permanent posts or stations and the Organized Militia at moblization camps. Little is required of the Medical Department at the time of moblization in connection with the preparation of organizations of the Regular Army for active service. Field equipment is maintained at designated stations or depots in readiness for service at all times; the men of the Hospital Corps available for service with line organizations and with the sanitary train are designated in time of peace and are in readiness to join their respective units. The men composing the line organizations have been given thorough physical examinations which have been made of record, and they have been vaccinated against smallpox and typhoid fever. Each man is equipped with a first-aid packet and has been instructed in its use. So far as the Medical Department is concerned, therefore, these troops should be in readiness to proceed from their points of mobilization to the camps of concentration on short notice.

Mobilization camps for the Organized Militia are provided in each State. An officer of the Regular Army commands each camp and has on his staff a camp surgeon, usually a medical officer of the Regular Army. Mobilization camps are operated under the control of department commanders, who are responsible for the complete preparation and equipment of the troops which assemble there. The work of the Medical Department at these camps is supervised by the department surgeon and the sanitary inspector of the department. The camp surgeon is provided with an adequate corps of assistants. Physical examinations of troops mobilized are made and recorded in accordance with specific instructions from the War Department. Vaccinations against smallpox and typhoid fever are administered and records made thereof. Individuals and organizations are furnished such portions of their equipment as pertain to the Medical Department; and such training in sanitary matters is given both the line troops and the sanitary troops as is possible, and appropriate to each. When for any reason it is impracticable to fully prepare individuals and organizations for service at the front, so far as this preparation devolves upon the Medical Department,

the camp surgeon will furnish a full report to the department surgeon showing what remains to be done in order that the latter may take the necessary steps to have the preparation of such individuals and organizations completed at the camp of concentration.

After mobilization, equipment, and preliminary training, the troops are assembled at concentration camps for immediate use against the enemy or for transport to an over-sea theater of operations. At camps of concentration the general instruction and training of line and sanitary troops in connection with the work of the sanitary service is conducted under the direction of the camp surgeon.

On leaving camps of concentration, troops pass from the service of the interior to the theater of operations, where they come under the control of the commander of the field forces. They may pass directly into the zone of the advance or they may traverse the zone of the line of communications before reaching the zone of the advance, or they may be assigned to duty on the line of communications. In the latter case they may be assigned either to the service of defense, to the supply, sanitary, and telegraph service, or to the service of military railways. The relations and duties of the sanitary personnel in this zone are described in paragraphs 751 to 827 M. M. D.

The sanitary service of the zone of the advance is treated in detail in paragraphs 630 to 750 M. M. D. The purpose of the service in camp, on the march, and in combat is to render temporary aid to the sick and wounded and to expedite their transportation to the rear, always making such disposition as will secure the retention at the front of all men fit for duty and relieve the fighting force of the impediment incident to the presence of men incapacitated for duty. To that end the service of the advance is assisted by the service of the line of communications, if one has been organized; otherwise directly by the service of the interior. In either event it cooperates with the advance station of the service in its immediate rear. When battle is imminent, the resources of the sanitary service behind the zone of the advance are placed in readiness to meet the demands for the care and transportation of the wounded which may reasonably be expected, and personnel and supplies are advanced as near the seat of operations as practicable, reaching forward into the zone of the advance if conditions warrant it.

The troops engaged in combat are accompanied by medical officers and Hospital Corps attendants; ordinarily a medical officer with a detachment of Hospital Corps men accompanies each battalion into combat, and the surgeon of each regiment with the equipment carried on a pack mule establishes an aid station. The wounded apply their own first-aid dessings, if practicable, and the sanitary personnel attached to organizations render first aid as soon as possible. The sanitary personnel with each battalion collect the wounded in groups and transport those who are unable to walk to the regimental aid station. Men with trivial wounds are sent back to their commands when their wounds are dressed, and those slightly wounded but able to walk are directed to the station for slightly wounded several miles in the rear, in order that dressing stations and field hospitals may not be unnecessarily congested by the presence of this class of men.

At the aid stations the sanitary service with troops connects with the service of the sanitary train. Each ambulance company establishes a dressing station in a protected location usually some distance in rear of the aid station. The dressing stations send forward bearers to remove the wounded who have been brought in to the aid stations. At the dressing stations light nourishment is provided, dressings are examined and adjusted or reapplied, as conditions may require, and the patients who require transportation are made as comfortable as possible until it is practicable to transport them to the rear, usually to the field hospitals. Whenever possible the dressing stations are so located that they can be reached by wheel transportation, and the wounded are sent to the field hospitals in ambulances.

The field hospitals do not perform the functions of civil hospitals or of base or general hospitals, in that their equipment is limited to those things necessary to provide shelter, nourishment, and emergency treatment for patients until they can be transferred to the immediate units at the rear. At the field hospitals no beds or cots are provided. The patients are placed on straw over which blankets are spread. The service of the zone of the advance conducted by the division surgeon terminates with the field hospitals. The units of the line of communications pushed forward into the zone of the advance relieve the field hospitals of their sick and wounded as rapidly as possible.

One of the evacuation hospitals held in readiness at the head of the line of communications will ordinarily receive the patients from the field hospitals. In some cases an evacuation hospital is pushed forward and takes charge of the patients at the location of the field hospital; in other cases transportation from the advance section of the line of communications is sent forward to the field hospital to receive the patients, and in many cases the wagons going to the rear for supplies will transport the patients back to the refilling point where they will be turned over to the wagons sent forward from the advance section. The evacuation hospital is the first sanitary unit in which provision is made to retain patients for any length of time. It is equipped with cots, blankets, and a liberal supply of comforts for the sick, but ordinarily the evacuation hospitals will be cleared of patients as early as practicable in order that they may be ready to receive others from the front. The patients are usually sent back by trains or boats to the base hospitals where all possible comforts and facilities for their care are provided. All sick and wounded who will be able to return to duty within a reasonable time will be retained in their hospitals rather than turned over to the service of the interior. Patients who no longer need medical attention are placed in convenient camps operated in connection with the base hospitals until they regain sufficient strength to return to their commands. The base is the great center of medical activity of an army. Personnel and supplies intended for the Army are accumulated here and sent forward as required. The sick and wounded are sent back to the base and cared for. Records of both supplies and personnel are kept at the base, and such abstracts and tabulations as the chief surgeon of the field army may require from time to time are made here and supplied to him.

The losses at the front are being constantly replaced by men sent forward through the channels above described. New recruits are sent to the mobilization camps where they are equipped and drilled and pushed forward to meet the demands in the zone of the advance.

Supplies furnished by the Medical Department for troops at the front are ordinarily obtained through the supply depot at the head of the line of communications on requisitions approved by the division surgeon. Each sanitary formation may make its own requisition, and its supplies may be sent forward from the advance section

to the refilling points where the transportation furnished by the line of communications turns over the supplies to the transportation sent back from the divisional organizations. The stream of supplies coming forward, consisting of rations, clothing, and ammunition, is constant, and ample opportunity is afforded to bring up the articles required by the sanitary service with the other supplies. When found to be more convenient the regimental sanitary supplies may be replenished from camp infirmaries or from the supplies carried by ambulance companies, these latter making requisitions for the supplies which they require. The supply depot at the advance section draws its supplies from the depot at the base, the stock of which is automatically maintained by the service of the interior.

PART II

ANATOMY AND PHYSIOLOGY

In order that the hospital corps man may intelligently perform his numerous duties in connection with the sick and wounded, it is necessary that he should understand something of the structure of the human body and the functions of its various organs. It is not intended to give him that little incomplete knowledge that is a "dangerous thing," but rather a knowledge which, while not like that of a physician, is complete as far as it goes.

CHAPTER I

THE SKELETON AND JOINTS

The skeleton is the bony framework of the body, gives it stability and form, and protects the organs, while the joints permit of motion.

Bone is composed of about one-third animal matter, mostly gelatin, and two-thirds mineral matter, chiefly lime salts. The animal matter gives bone its toughness and elasticity; this may be demonstrated by leaving a bone for some time in dilute acid by which the mineral matter is removed and the gelatin alone is left; the bone may then be tied in a knot. The mineral matter gives the bone its hardness; the animal matter is all removed by burning the bone which then becomes brittle as chalk. Young bones contain more animal matter and are hence tougher and harder to break; when they do break, the fracture is apt to be incomplete like a broken green stick. Elderly persons' bones break easily because they contain more mineral matter.

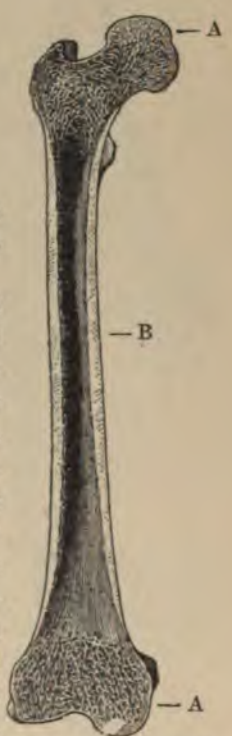

Fig. 3.—Section of Femur. *A*, *A*, Cancellous tissue; *B*, compact tissues.

If you saw a long bone across, the end will be found spongy or *cancellous,* while the shaft is *compact* and dense. The shaft is also hollow and contains *marrow* (Fig. 3).

Bone is covered by a vascular membrane, the *periosteum,* which nourishes the bone; where the periosteum is stripped off, the bone is apt to die from insufficient nourishment, the death of the bone being known as *caries* or *necrosis.*

FIG. 4.— Skeleton.

The bones of the human body number about two hundred, without counting the thirty-two teeth and some accessory small bones; taken together with the cartilages they compose the skeleton. *Cartilage,* or *gristle,* is an elastic substance, like bone without mineral matter; it is seen extending from the lower ribs to the breast bone and covering the ends of the long bones.

The bones are classified as *long, short, flat,* and *irregular.*

The *long bones,* of which the thigh bone is an example, form a system of levers which support the weight of the body and provide the means of locomotion. The *short bones,* such as those of the wrist, are found where strength and limited motion are the requisites; the *flat bones,* of which the bones of the skull are an

example, serve principally for protection; the *irregular bones* are illustrated by those of the pelvis.

In considering the skeleton (Fig. 4) let us start from the *vertebral column,* also called the *spinal column, spine,* or *backbone.* The name *vertebra* is given to each separate bone composing the column. The separate bones are not allowed to rub against each other, but are separated by pads or buffers of elastic cartilage, and at the same time tied together with strong fibrous *ligaments.*

These buffers of *intervertebral substance* break up and distribute the shock which would otherwise result from falls or in jumping.

On looking at the spine (Fig. 5) it will be observed that it increases in size from above downward, which is but natural when one considers the increase in weight to be borne by the lower part as compared with the upper. The highest vertebræ, those of the neck, seven in number, and called *cervical,* support the head only. Next in order come the twelve *dorsal,* which in addition support the ribs, chest, and upper extremities. In the next region, the *small of the back,* are found the five massive *lumbar* vertebræ, which have the entire trunk to support. The vertebral column ends in two large masses of bone known as the *sacrum* and the *coccyx* or tailpiece. In the growing youth the sacrum is composed of five separate bones and the coccyx of four, but in the adult these separate bones are welded into one mass.

FIG. 5.—Spinal Column. *A*, Cervical; *B*, dorsal; *C*, lumbar; *D*, sacrum; *E*, coccyx.

Each vertebra consist of a solid *body* in front and an *arch* enclosing a central cavity behind. When the vertebræ are in their natural position one resting upon another, the arches together form a canal, the *spinal canal,* which in the living body contains and protects the *spinal cord.*

This spinal cord is everywhere in contact with the bony canal in which it lies, so that when a fracture or dislocation of the spinal column occurs a laceration of the cord is almost certain to occur, and it is this coincident injury to the cord which gives to these injuries their special importance.

If the fingers are drawn along the center of one's back they come in contact with a number of projecting bony points; these are the *spinous processes* of each vertebra and are situated on the back of the arch.

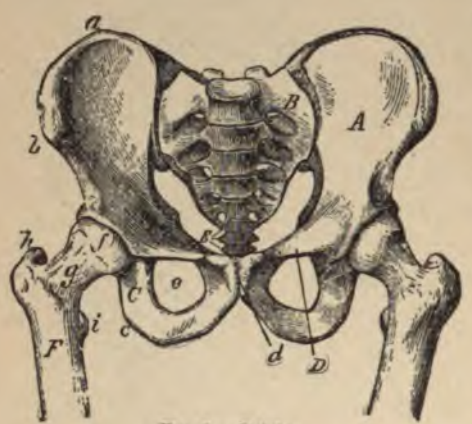

FIG. 6.—Pelvis.
A, Innominate bone; *B*, sacrum; *E*, coccyx.

Both the sacrum and coccyx take part in the formation of the large girdle of bone met with at the lower part of the trunk under the name of the *pelvis*, or basin (Fig. 6), and which receives the weight of the body and hands it over to the lower extremities at the hip joints. The sacrum forms the keystone of the arch, the sides of which are composed of the two *innominate bones* or *nameless bones*, separated in front by a pad of cartilage, and all locked together by powerful ligaments.

Within the pelvis are situated the urinary bladder in front and the rectum behind, and, in the female, between the two is placed the uterus. Each innominate bone consisted originally of the three bones, the *ilium*, *ischium*, and *pubis*, but these become fused together so as to form one bone in the adult. On each side of the pelvis is seen a cup-shaped cavity in the innominate bone, known as the *acetabulum*, the purpose of which is to receive the spherical head of the *femur*, so as to make the hip joint.

A *joint* is the place where two bones meet and move upon each other; the ends of the bones are covered with smooth cartilage and to still further prevent friction the cartilages and the whole joint are enclosed in a smooth, glistening membrane, the *synovial membrane*, which secretes the *synovia* or joint oil.

Outside the synovial membrane the bones are firmly bound together by fibrous *ligaments*, while the joint is still further strengthened by the surrounding muscles. A joint, therefore, consists of bones, cartilages, synovial membrane, and ligaments.

Joints differ very much in their character and the kind of motion they permit. Thus we have the almost perfect freedom of motion permitted by the *ball-and-socket joints*, like the shoulder and hip, the more limited motion of *hinged joints*, like the knee, and the almost motionless, imperfect joints, such as the *sutures* of the skull.

A *dislocation* is a slipping away of the joint surfaces from each other to such an extent that they remain "out of place" and the joint is locked; in such a deep, strong joint as the hip, violence is more apt to give rise to fracture than to dislocation.

Fig. 7.— Femur.

Entering into the formation of the hip joint is the *thigh bone* or *femur* (Fig. 7), the largest and longest bone in the body. Like other long bones it has a *shaft* and *two extremities*. The upper extremity consists of a *head, neck* and two *trochanters*. The head is globular and attached to the shaft by a narrow neck set at an angle; it is in this narrow neck that fracture so frequently occurs.

The trochanters are merely bony knobs to which muscles are attached to move the joints; the *great trochanter* is the bone which you may feel just under the skin on the outer side of the hip. The lower extremity of the femur is expanded into two broad *condyles* which with the upper end of the *tibia* or *shin-bone*, and the *patella* or *knee-cap* (Fig. 8) form the *knee-joint*. The patella is the small round bone lying just in front of the knee and in the extended position of the leg is freely movable with the tendon in which it lies.

Fig. 8.— Patella.

The knee joint is the largest in the body and from its exposed position one of those most liable to injury; once injured it is apt to be sensitive ever afterward.

Beyond the knee we come to the leg composed of the *tibia* on the inside and the *fibula* or *splint bone* on the outside (Fig. 9). The

tibia is a strong prism-shaped bone, the inner surface and front edge just beneath the skin and constituting the *shin;* on account of its being just beneath the skin, fractures of this bone are apt to be *compound.* The fibula is a long slender bone deeply buried under the muscles; it is frequently broken just above the ankle where it can be felt; such a break is known as a "Pott's fracture."

FIG. 9.—Tibia and Fibula.

The ankle joint is made up of the tibia and fibula above and the astragalus below; it is a strong joint, so much so that while it is frequently subjected to violent wrenches and strains, dislocation seldom occurs; under such conditions the joint surfaces do not slip entirely away from each other, but the ligaments and synovial membrane are torn and blood is poured out into and about the joint, constituting the condition known as *sprain.*

Beyond the ankle is the *foot,* composed of the *tarsus, metatarsus,* and *phalanges.* The tarsus, besides the *astragalus,* already referred to as helping to form the ankle joint, contains the *os calcis* or heel bone, and five other small bones, making seven in all.

The metatarsus lies in that part of the foot just behind the toes, and is composed of five long bones. The *phalanges* or *toe joints* are so called because they are arranged in phalanx or rows; there are three for each toe except the great toe which has only two.

To go back to the vertbral column. Connected with its dorsal portion are twelve *ribs* on each side, and closing in the space between the ribs in front so as to form the *thorax* is the *breast bone* or *sternum.*

It is scarcely necessary to say that the number of ribs is the same in man as in woman, though there is an old tradition that Adam lost one rib in order to gain a wife. The seven upper ribs are connected directly to the sternum in front by their cartilages and are known as *true ribs;* the five remaining are known as *false ribs,* and the last two which are not connected with those above are known as *floating ribs.* The *breast bone* or *sternum* is composed of three parts and extends

from the root of the neck to the pit of the stomach. The *thorax* or *chest* so formed is a bony cage which encloses and protects the heart and lungs; it is separated from the abdomen by a broad, muscular partition, arching upward and known as the *diaphragm*.

Connected with the thorax is the upper extremity composed of the *shoulder* and *shoulder joint, arm, elbow joint, forearm, wrist joint,* and *hand*.

The shoulder is composed of the *clavicle* or *collar bone* and the *scapula* or *shoulder blade*. The clavicle (Fig. 10) is a very strong

FIG. 10.— Clavicle.

bone with a double curve like the Italic letter *s*. It is connected at one end with the breast bone and at the other with a process of the shoulder blade known as the *acromion;* it is the acromion process which we feel just under the skin at the point of the shoulder. The clavicle notwithstanding its strength is very frequently broken owing to its fixed position and the fact that it receives the jars transmitted through the upper extremity when one tries to save himself in falling by throwing out the arm. The *scapula* (Fig. 11) is a freely movable flat bone connected at one end with the collar bone to form the arch of the shoulder; its outer angle or head contains a shallow, saucer-shaped depression known as the *glenoid cavity* for the reception of the head of the humerus to form the *shoulder joint*. The shoulder, like the hip, is a ball-and-socket joint, but unlike the hip, the socket is very shallow, so that the head of the humerus in the very free motion permitted easily rolls over the edge and becames dis-

FIG. 11.— Scapula.

located; as a matter of fact dislocation at the shoulder joint is many times more frequent than at all the other joints of the body put together, so that in obscure injuries to the shoulder we always look for dislocation.

The arm is that portion of the upper extremity which lies between the shoulder and elbow; like the thigh it contains but one bone, the *humerus* (Fig. 12). The upper end of the humerus consists of the *head* and the *tuberosities*, the *anatomical neck* lying between the two, and the *surgical neck* being the constricted portion of the shaft just below the tuberosities; the surgical neck is so called because it is the part most frequently broken.

Fig. 12.—Humerus.

The lower end of the humerus is expanded to form the elbow joint and has a projection on each side known as a *condyle*.

The elbow joint is made up of the humerus and the two bones of the forearm, the *radius* and *ulna* (Fig. 13).

The *radius* lies on the outer side of the arm and is so called because it radiates about its fellow in the motion of *pronation*, in which the palm of the hand is turned down, and *supination*, in which the palm is turned up. The radius has a small *head* which takes but little part in the elbow joint, but a large lower end which with the *carpus* forms the wrist joint to the entire exclusion of the *ulna*. It is because of the radius resisting almost alone the force of falls upon the hand that it is broken so much more often than the ulna. Such a break just above the wrist joint is very common and is known as a "Colles's fracture."

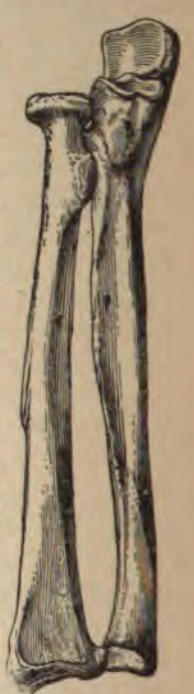

Fig. 13.—Radius and Ulna.

The *ulna* has its upper end most highly developed, forming a projection which extends back behind the elbow joint, protecting it in the same manner as the patella does the knee joint. This protection forms the "point of the elbow" and is called the *olecranon*.

The *wrist* or *carpus* is composed of eight small bones in two rows of four each, the upper row together with the lower end of the radius forming the *wrist joint*. The hand is composed of the five *metacarpal* bones, while the fingers have three rows of *phalanges*, except the thumb which has two only.

Balanced on the top of the spinal column and forming a joint with its uppermost vertebra is the skull (Fig. 14). The *skull* is usually considered in two parts, the *cranium* which contains the *brain*, and the *face*. The cranium is that part which lies above a line drawn from the nape of the neck through the ears to above the eyebrows, and the brain here lies everywhere in contact with the bone so that a fracture of the cranium like one of the spine, derives its special seriousness from the accompanying injury to the brain. In front, however, just over the eyes, the two plates of which the cranial bones are composed separate to leave a space known as the *frontal sinuses;* here fractures of the outer plate may occur without injury to the brain. The cranium varies in thickness from about that of paper at the temples to a quarter of an inch or more behind.

FIG. 14.—Skull. *a*, Nasal bones; *b*, superior maxilla; *c*, inferior maxilla; *d*, occipital bone; *e*, temporal bone; *f*, parietal bone; *g*, frontal bone.

The visible portion of the cranium is composed of six bones, the *frontal* in front, the *occipital* behind, the two *parietals* on the top, and the two *temporals* on the sides. In the lower part of the occipital bone is a large round hole known as the *foramen magnum* through which the spinal cord makes connection with the brain.

The face is composed of fourteen bones, arranged mostly in pairs, and forming the two *orbits*, the *nose*, and *mouth*. The only facial bones necessary to remember are the two, tiny, *nasal bones* which form the arch of the nose, and the two *superior maxillary bones* and

the *inferior maxillary bone* which contain the teeth and enclose the mouth.

The inferior maxillary is the only movable bone of the face; its joints with the upper jaw lie just in front of the ear where the head of the bone can be felt to move when the mouth is opened.

The *teeth* appear in two crops; the first, ten in number in each jaw, are known as the *milk teeth;* at the end of the sixth year they begin to be replaced by the *permanent teeth,* sixteen in each jaw. The second dentition is not concluded until about the twenty-first year when the wisdom teeth or last molars appear.

FIG. 15.—Section of Lower Molar. *a*, Dentine; *b*, enamel; *c*, crusta petrosa; *d*, pulp cavity.

Every tooth has a *crown,* the part above the gum, a *neck,* the constricted portion just below the crown, and a *root,* the part embedded in the jaw. In structure (Fig. 15) they are composed of *enamel,* the hard surface covering, the *dentine* which comprises the mass of the tooth, the *cement* which covers the root, and the *pulp* composed of nerves and blood-vessels which nourishes the tooth and lies in its interior. When the teeth are not properly cared for the protective

Canine or Eye Tooth of Upper Jaw. | Second Bicuspid of Lower Jaw. | Central Incisor of Upper Jaw. | Second Molar of Upper Jaw. | Wisdom Tooth of Upper Jaw.

FIG. 16.

enamel cover breaks down, exposing the dentine which rapidly decays, undermining the enamel and finally exposing the sensitive pulp; pain then begins, and unless the tooth is filled death of the pulp occurs and the tooth is lost.

The four front teeth in each jaw are adapted to cutting and are called *incisors;* next to these on each side is a tearer or *canine* tooth, and then two *bicuspids;* all of these usually have a single root. After the bicuspids come three *molars* or grinders on each side. The up-

per molars usually have three roots, two on the outer side and one on the inner, while the lower molars generally have two roots. A knowledge of the number and arrangement of the roots of the teeth is necessary in order to select the proper pair of forceps to use in tooth extraction (Fig. 16).

CHAPTER II

THE MUSCLES, CELLULAR TISSUE, AND THE SKIN

Muscles are simply *lean meat.* Each muscle is composed of a number of fibers held together by *connective tissue,* and collected into bundles which are enclosed in a sheath of fibrous tissue known as *fascia.*

FIG. 17.—Fracture of Thigh. Deformity from muscular action.

The function of muscles is to contract and thereby move the various parts and tissues of the body; their tendency to contract is constantly present during life, so that if a muscle is cut the two ends at once pull apart and a gaping wound is left. For the same reason if a bone is broken the contracting muscles on each side of the fracture have a tendency to shorten the limb, making the ends of the bone override each other and produce deformity (Fig. 17). It is this muscular contraction which must be overcome in setting fractures or reducing dislocations.

As muscles taper toward the ends they become more and more fibrous until white, glistening *tendons* or *sinews* are formed which finally blend with the periosteum at the point of attachment to bone.

Most muscles, like those of the limbs, are under the control of the will and are known as *voluntary muscles* (Fig. 18), while others, like those of the heart and intestinal tract, are entirely *involuntary.* This involuntary action of the important muscles which preside over the necessary functions of life is a wise provision of nature; otherwise one might forget to breathe or make the heart beat, and sleep would be out of the question.

The muscles in their action upon the bones produce various special motions; bending a limb is called *flexion,* straightening it is *extension;* turning the palm down is *pronation,* turning it up *supi-*

nation; motion of the limb on its long axis is *rotation*. *Abduction* is throwing a limb out from the body, while drawing it toward the body is *adduction*.

FIG. 18. — Superficial Layer of Voluntary Muscles.

In a variable time after death *rigor mortis* sets in, a change in the muscles by which they become rigid, and remain so until decomposition begins. When the person has undergone great muscular exer-

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tion to the point of exhaustion just before death this change takes place almost immediately, so that the soldier killed in battle may be found rigidly fixed in the same position in which he met his death.

The only voluntary muscles which it is necessary for you to remember are the *sterno-mastoid,* the *biceps,* and tre *diaphragm.* Important involuntary muscles are the *heart, stomach,* and *bladder.*

The *sterno-mastoid* is the prominent muscle seen on each side of the neck when the head is turned in the opposite direction and extending from behind the ear to the top of the sternum; its front edge is a guide to the carotid artery. The *biceps* is the big muscle on the front of the arm, familiar to all, and the inner border of which is a guide to the brachial artery.

The *diaphragm* is the great muscular partition between the thorax and abdomen.

The *connective* or *cellular tissue,* so called because of the spaces contained in its spongy structure, connects together all the other special tissues, and serves as a support for the blood-vessels, nerves, and fat.

The fat is the padding which fills in empty spaces and gives form and pleasing outlines to the body. Its important functions are to serve as a reserve of nutritive material for emergencies, and to act as a blanket in retaining the bodily heat. The emaciation which follows an exhausting illness is largely due to the using up of the reserve fat, and everyone is familiar with the fact that a fat person stands cold better and heat less well than a thin one.

The *skin* is a tough, elastic membrane which covers the entire body and is continuous at the various orifices with the *mucous membrane.* Anatomically it consists of two layers, the *cuticle,* and the *derma* or *true skin.* The *cuticle* is that part which is raised when a blister occurs and which peels off after scarlet fever.

The *derma* constitutes the greater part of the thickness of the skin, and contains the blood-vessels, nerves, sebaceous and sweat glands.

The appendages of the skin are the *hair* and the *nails* which are modified cuticle (Fig. 19).

The *sebaceous glands* secrete an oily substance which gives to the skin its softness and plialility; the orifices of the ducts of the sebaceous glands are particularly large about the face and nose, and when plugged with dirt form the familiar *black-heads.*

The sweat glands are in vast numbers all over the body and their orifices constitute what are known as the *pores*. They secrete a variable amount of water, averaging about two pints a day, and the water contains organic matter and salts, and constitutes the *perspiration* or *sweat*.

The functions of the skin are to protect the underlying parts from injury, from the invasion of bacteria, and from undue evaporation;

FIG. 19. — Perpendicular Section of the Skin, showing: *a*, The epidermis, cuticle, or scarf skin; *b*, a layer of dark-colored cells; *c*, the papillæ on the surface of *d*, the corium, derma, cutis vera, or true skin, and *e*, the fat cells underlying it; *f*, a perspiratory pore or aperture, *g*, the duct, and *h*, the coiled substance of a sudoriparous gland; *i*, the shaft of a hair, *k*, its root, and *l*, sebaceous glands communicating with the interior of the hair follicle.

to receive the nerve ends and thereby serve as a special organ of touch; and through the agency of the sweat glands to act as an important excretory apparatus and a regulator of bodily temperature.

The importance of a whole skin as a protection against the bacteria of disease is well known; subcutaneous wounds, that is contusions, give us little anxiety, but if the skin is broken special dressings must be applied to take its place. Plague frequently invades the body through a break in the protective wall of the skin and syphilis is contracted in the same manner.

The excretory function of the skin, by which it throws off poisonous waste products dissolved in the perspiration, is illustrated by what happens in extensive superficial burns by which this function of the skin is destroyed; the man becomes poisoned by his own waste products and death is the result.

As a temperature regulator its action is shown by the increased perspiration in hot weather, the evaporation of the water serving to cool the body; conversely in winter perspiration is imperceptible.

The skin has also absorbing powers; thirst may be allayed by prolonged immersion in a bath; the vapor of mercury and even metallic mercury may be taken up through the unbroken skin.

CHAPTER III

THE NERVOUS SYSTEM AND SPECIAL SENSES

THE *nervous system* consists of the *brain, spinal cord,* and the nerves constituting the *cerebro-spinal system,* and the *ganglia* and connecting nerves composing the *sympathetic system.*

The *brain* situated within the cranium is the seat of the intellect and will, and the great headquarters telegraph office from which all the orders for motion are sent out and to which all the reports called sensations are forwarded. The *spinal cord* extends downward from the brain through the spinal canal and is largely an aggregation of nerves or wires connecting the brain with all parts of the body. The ganglia (Fig. 20) are small masses of nervous matter arranged in pairs along the spinal cloumn and in groups about the heart and great viscera; they are connected with each other and with the cerebro-spinal system, and their distribution is to the heart, lungs, bood-vessels, the gastro-intestinal tract, and the great viscera.

The *nerves* are composed of bundles of minute tubules enclosed in a protective sheath, each of these tubules corresponding to a telegraph wire and ultimately reaching its destination without branching.

The *brain* (Fig. 21) consists of the cerebrum and cerebellum, and pons and medulla. The *cerebrum* is the soft, pulpy, oval mass which is seen when the top of the cranium is removed; it is divided from before backward by a deep fissure, almost but not quite complete, so that there is a bridge left connecting the two halves.

The surface of the brain presents numerous grooves or *sulci,* between which are the *convolutions.* The exterior is composed of *gray matter,* and the interior of *white matter,* the latter being nothing more than a collection of nerves connecting the various parts of the brain with each other and with the spinal cord. In the interior of the cerebrum are a number of cavities known as *ventricles.* The gray matter is the seat of the mind.

The brain is very delicate and easily injured; injuries or even slight pressure seriously interfere with its functions. So when a

fracture of the skull occurs with depression of bone, or even a slight bleeding from one of the cerebral vessels, pressure on the brain

FIG. 29.—Sympathetic System of Ganglia and Nerves.

results and we have unconsciousness or paralysis or both; this is the condition in apoplexy which is merely a hemorrhage within the cranium; as the blood cannot escape it must produce pressure.

Lining the interior of the cranium is a strong fibrous membrane which protects and suspends the brain and is called the *dura mater;* this with the *pia mater* and *arachnoid* constitute the *meninges* or membranes, inflammation of which is known as *meningitis.*

If we lift up the back part of the cerebrum we see below it a small mass of nervous tissue known as the *cerebellum* or *little brain* (Fig. 22). It is chiefly concerned with the maintenance of the equilibrium of the body.

FIG. 21.—The Hemispheres of the Brain. *A*, The right; *B*, the left divided from before backward by *a*, *b*, the longitudinal fissure, and connected by *c*, the bridge of transverse fibers called the corpus callosum. On the right side the convolutions and sulci are shown; on the left the upper part of the convexity of the hemisphere has been cut away to show the gray matter *d*, *d*, dipping into the sulci and appearing as islands, *e*, *e*, in the interior of the white matter; the elongated cavity with curved extremities is the lateral ventricle of that side.

The *pons* is the connecting link between the cerebrum and medulla and between the two lobes of the cerebellum.

The *medulla oblongata* is the enlarged upper end of the spinal cord lying just within the cranium, and containing the important nerve centers presiding over the action of the heart and lungs. It is also the part in which the nerves coming from each side of the brain cross over to the opposite side of the spinal cord, so that an injury of the brain above this crossing causes a paralysis on the opposite side of the body.

The *spinal cord* (Fig. 23), like the brain, is enclosed in membranes and is a tail-like column of nervous tissue composed chiefly of nerves but containing in its interior a central column of gray

tter. A pair of nerves leave it opposite each vertebra, those of cervical region being arranged in two groups. The upper group plies the face and neck and the interior of the chest; one of the st important of the branches is the *phrenic* which controls the vements of the diaphragm. The lower group is known as the *chial plexus* and supplies the upper extremity.

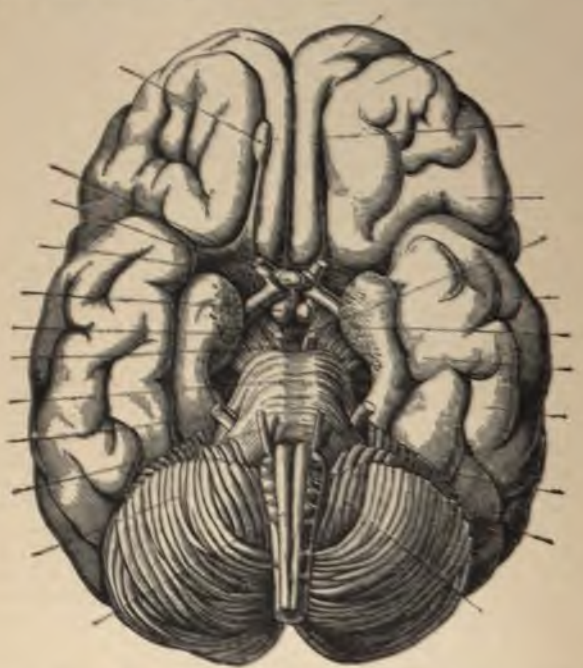

FIG. 22.—Lower Surface of Brain. *C*, Cerebellum; *M*, medulla; *P*, pons.

he *dorsal nerves* supply the chest wall, those of the *lumbar* and *al* regions go to the pelvis and lower extremities; one great cord ch emerges from the pelvis on each side and passes down the k of the thigh is called the *sciatic nerve;* it is often the seat of neuralgic pain known as sciatica.

s all the nerves of the body except those of the face must pass ugh the spinal cord on their way to the brain it is evident that if spinal cord is cut completely across there must be paralysis of all parts below; such a paralysis is called *paraplegia*. If the injury igh enough up the nerves controlling the action of the heart and

lungs are involved and death quickly follows. As the motor nerves are cellected in the front part of the spinal cord and the sensory nerves in the back part, a partial injury of the cord may cause paralysis of motion without affecting sensation or *vice versa*.

There are two kinds of nerve tubules, *motor* and *sensory*. The former convey from the brain orders directing motion, while the latter carry to the brain information as to sensation. If a motor nerve is cut the muscles supplied by it are paralyzed because orders from the brain can no longer reach them; if a sensory nerve is cut sensation is lost in the part supplied by it because information as to the sensory condition of the part can no longer reach the brain. Usually nerves contain both motor and sensory fibers, but some nerves, like the facial, are purely motor.

FIG. 23.—Spinal Cord and Nerves.

There are certain reports and impressions which are sent by way of the nerves from various parts of the body which it is not necessary to refer to the brain for its action; the necessary action is provided automatically by what is called *reflex action*.

The quick withdrawal of the hand when it touches something hot and the rhythmical contraction of the heart under the stimulus of its distention with blood are instances of reflex or automatic action originating respectively in the gray matter of the spinal cord and ganglia.

FIG. 24.— Section of Nose. *A*, Olfactory nerves.

The *special senses* are *touch, taste, smell, hearing,* and *sight.* The three latter are presided over by special *cranial nerves,* that is, nerves coming directly from the brain without passing through the spinal cord.

The sense of *touch* is resident in the skin generally, but is most highly developed in the ends of the fingers.

The sense of *taste* is located in the mouth, more especially in the tongue; for its action it is necessary that the substance should be in solution; this is in accordance with our knowledge that insoluble medicines are tasteless.

The sense of *smell* resides in the upper nasal cavities where the filaments of the *olfactory nerve* are distributed to the mucous membrane (Fig 24).

Hearing or the perception of sound vibrations is provided for by the ear through the auditory nerve. The ear (Fig. 25) consists of the *ex-*

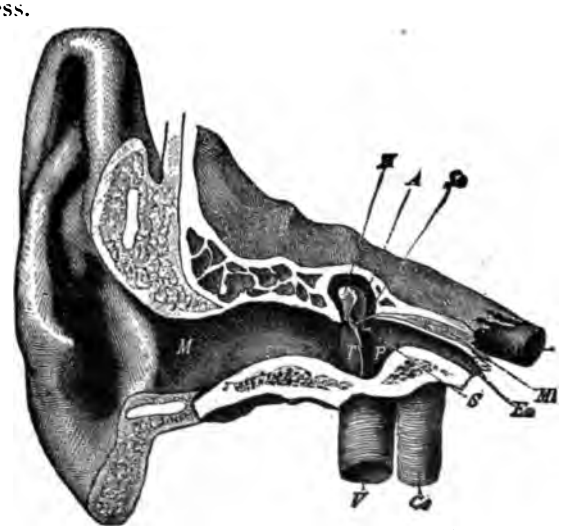

FIG. 25.— Section of the Ear. *B*, External ear; *A*, auditory canal; *T*, tympanum; *P*, middle ear; *H*, ossicles; *E*, Eustachian tube.

ternal ear, the *auditory canal,* the *tympanum* or *drum membrane,* the *middle ear,* stretching across which are the small bones or *ossicles,* and the *internal ear.* The tympanum is stretched like a drum-head across the auditory canal, separating the external and middle ears; in order that the air pressure on the two sides of the drum may be equalized there is an air tube leading from the middle ear to the throat and known as the *Eustachian tube;* stoppage of this tube in chronic inflammation of the throat is one of the causes of deafness.

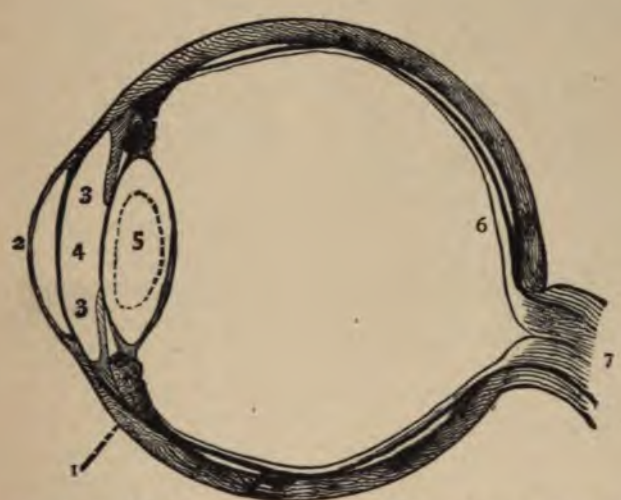

FIG. 26.—Section of the Eye. 1, Conjunctiva; 2, cornea; 3, 3, iris; 4, pupil; 5, lens; 6, retina; 7, optic nerve.

The sense of *sight* consists in the perception of light, color, form, size, and distance; it is resident in the eye.

The *eye* (Fig. 26) is situated in the orbit, the projecting upper border of which, together with the quickly moving lids, give it protection. It is covered in front by a thin vascular membrane which also lines the lids and is known as the *conjunctiva.* Light enters through the transparent *cornea* which is set in front of the eye like a watch-glass; behind the cornea is hung a curtain of muscular fibers variously colored and called the *iris;* the black *pupil* is really a hole in the iris to let in the light which then passes through a *crystalline lens* just behind the pupil and is brought to a focus on the *retina;* the

retina is merely an expansion of the *optic nerve* which transmits the luminous impressions to the brain. The dense white outer coat of the eye, lying beneath the conjunctiva, is known as the *sclerotic.*

The eye is a camera, focusing being accomplished by changes in the convexity of the lens effected by the contraction of the *ciliary muscle,* the muscle of *accommodation.*

Color-blindness is the inability to distinguish certain colors, particularly reds and greens.

CHAPTER IV

THE DIGESTIVE APPARATUS

INASMUCH as the nutritive constitutents of the blood are being constantly used up in the repair of tissue and the production of heat and force, it is necessary that some provision should be made for a constant supply of new material. This is done by the food through the digestive apparatus; the function of the digestion is to prepare the food for absorption and nutrition.

Foods are usually classified according to certain definite compounds or *alimentary principles* which they contain; these are four in number: 1. *Albuminates, nitrogenous substances* or *proteids;* 2. *Fats* or *hydrocarbons;* 3. *Starches* and *sugars* or *carbohydrates;* 4. *Minerals,* including *water* and *salts.*

The especial uses of these alimentary principles in nutrition are as follows: The *albuminates* are essential for the repair of all the nitrogenous constituents of the body, that is to say, they are muscle and blood builders; they regulate the absorption and use of oxygen; they sometimes form fat, and hence force and heat. The *fats* produce force and heat, prevent the waste of the nitrogenous tissues, and serve as a reserve of heat and force. The *starches* and *sugars* also are readily convertible into heat and work, and, though they have little part in the composition of the tissues of the body, they contribute directly or indirectly to the deposit of fat. Water constitutes nearly 60 per cent of the human body and is the most important constituent of foods; without the other foods one may live weeks, but without water it is a question of a very few days. Water is the great solvent without which even the circulation of the blood can not go on.

The various *salts* are also essential; the alkaline carbonates formed from the salts of the vegetable acids maintain the necessary alkalinity of the blood and body fluids; without a due proportion of them *scurvy* occurs.

All these alimentary principles are necessary for life; some one or

more of them are contained in all foods; if any one food contained them all in proper proportion that substance would constitute a complete diet; milk contains them all and in a complete form for infants, but for adults a mixed diet is necessary. Beef consists largely of albuminates, pork of fats, bread of starch, candies of sugar.

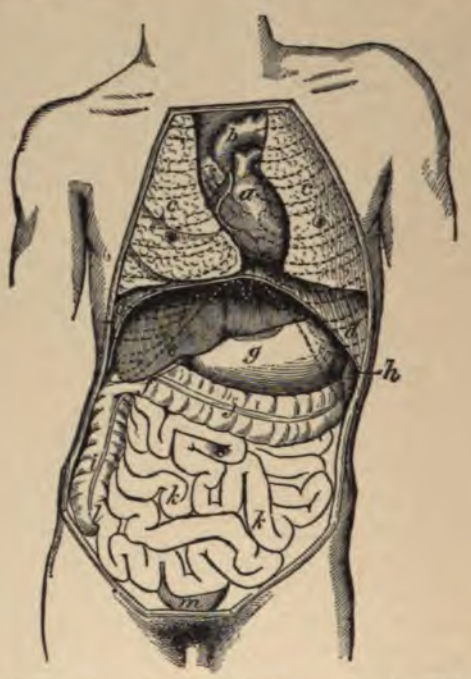

FIG. 27. — View of Thoracic and Abdominal Organs; anterior walls removed, but the relative position of the ribs, navel, etc., indicated. *a*, Heart; *b*, great vessels; *c*, *c*, lungs; *d*, *d*, diaphragm; *e*, liver; *f*, gall bladder; *g*, stomach; *h*, spleen; *i*, ascending colon; *j*, transverse colon; *k*, coils of small intestine; *l*, position of ileo-cecal valve at junction of small and large intestines; *m*, urinary bladder.

The proper quantity of the various articles of food necessary per day to maintain a man in good health while performing ordinary labor constitutes a *ration*.

Great exertion calls for an increase of the albuminates and fats, while great cold demands a special increase of the fats.

Now these alimentary principles, in the form they exist in in foods, are not ready for absorption; they must be reduced to soluble forms: the albuminates to peptones, the sugars and starches to glucose, and

the fats to an emulsion; to accomplish this is the purpose of the digestive apparatus.

When too much food is taken the excess is not digested but acts as a foreign body and causes irritation of the stomach and bowels, followed by pain and diarrhea, or the poisonous products of decomposition are absorbed, causing fever — auto-intoxication.

A deficiency of food causes the tissues of the body to be drawn upon and emaciation is the result.

The apparatus for the digestion of the food consists of the alimentary canal, and the salivary glands, liver, spleen, and pancreas. The *alimentary canal* includes the mouth, pharynx, œsophagus, stomach, small intestine, and large intestine; it is a muscular tube lined with mucous membrane, about thirty feet long and extending from the lips to the anus (Fig. 27).

In the *mouth* provision is made for the *mastication* of the food and its admixture with saliva; beyond this is the apparatus for swallowing, the *pharynx* and *œsophagus*, which convey the food to the *stomach*, where a partial reduction and solution of it take place; in the small intestine the digestion and solution are completed, and the nutritive principles, composing the *chyle*, are separated, by its admixture with the bile and pancreatic juice, from that portion which passes into the large intestine, most of which is expelled from the body.

In looking into the mouth (Fig. 28), we see the teeth and tongue, already described, and, stretching across the upper and back part, a fleshy curtain known as the *palate;* hanging down from the center of the palate is the *uvula*, and on either side behind the palate are the *tonsils*.

In the mouth the food is thoroughly broken up by the teeth and, assisted by the tongue, mixed with the saliva, and formed into a suitable lubricated mass for swallowing. The only digestion which takes place in the mouth is the slight conversion of the starch into sugar; nevertheless thorough mastication is of the greatest importance, as, the more completely the food is broken into small particles, the more easily the digestive fluids of the stomach and intestines get at the particles to dissolve them. If we wish to dissolve out the soluble constituents of a crude drug, we first pulverize it in a mortar, and the same principle obtains here.

After the food has been masticated it is pushed into the pharynx

by the tongue and there passes beyond the control of the will through the eight or nine inches of the *œsophagus* or gullet into the stomach.

The saliva comes from the *salivary glands,* which are three in number on each side, the *parotid, submaxillary,* and *sublingual.* The parotid glands are situated just in front of and below the ear, and are

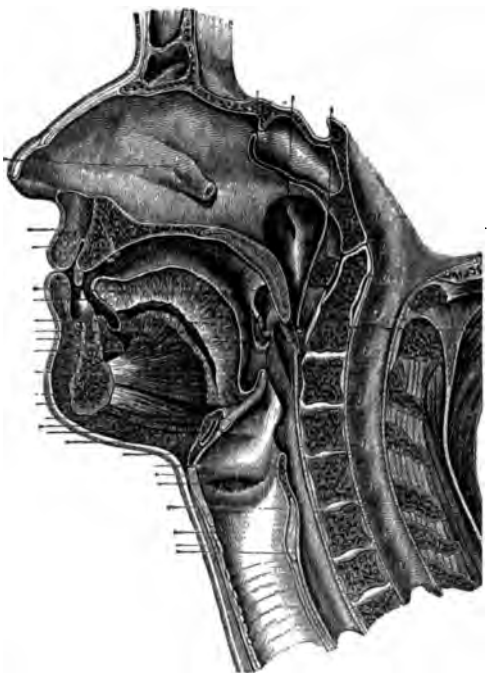

FIG. 28.— Section of Head and Neck.

the seat of the inflammation known as *mumps.* The other salivary glands are placed below the tongue and lower jaw.

The *stomach* (Fig. 29) is a muscular bag lined with mucous membrane, pear shaped, with the large end to the left and lying on the upper part of the abdomen, largely behind the ribs, and separated from the thoracic cavity by the diaphragm. The heart is just above it, with only the diaphragm between, so that it can easily be seen how distention of the stomach may cause disturbances of the heart and how pains in the stomach are so often referred to the heart.

The stomach opens into the œsophagus at one end and into the small intestine at the other by small openings known as the *cardiac*

and *pyloric* orifices, respectively. The *small intestine* is about twenty-five feet long, and lies in the central and lower part of the abdomen, extending from the stomach to the right groin, where it terminates in a valvular opening into the large intestine.

The *large intestine* is about five feet long. It commences at the termination of the small intestine in the right groin, this part of it being known as the *cecum* and having attached to its lower and

FIG. 29.— Stomach.

back part a tail-like appendage known as the *vermiform appendix;* this appendix, about the size of a goose quill and two to five inches long, is the part which is so frequently inflamed, constituting the disease called *appendicitis.*

The cecum as it passes up the right side of the abdomen is known as the *ascending colon;* under the liver it turns and crosses to the left in front of the stomach, becoming the *transverse colon;* on the left side of the abdomen it turns downward, the *descending colon;* in the left groin it makes a curve like the letter S, the *sigmoid flexure,* and ends in the *rectum,* which descends to the right and backward to the *anus.*

The intestines are covered with a smooth, shining membrane which lines the abdomen and is known as the *peritoneum;* inflammation of this membrane is called *peritonitis.*

The *omentum* is a sort of apron made of a fold of the peritoneum, containing much fat, which lies over the intestines and protects them. The *mesentery* is the name applied to other folds of the peritoneum

which bind the intestines loosely to the abdominal walls behind them. In the abdominal walls are certain weak places where blood-vessels pass out of the cavity and the intestines have a tendency to follow the vessels; these places are the *umbilicus* or *navel,* the *inguinal canal,* along which the vessels pass to the testicle, and the *femoral canal,* for those to the thigh. When the intestine does so escape we have *hernia, umbilical, inguinal,* or *femoral,* respectively.

FIG. 30.— Pancreas in Section to Show Its Duct.

In the upper part of the abdomen, on the right side and extending somewhat to the left, we have the liver (Fig. 27); it is the largest gland in the body, weighing between four and four and a half pounds, and in its natural state lies almost wholly behind the ribs. The liver has two large lobes, between which and projecting just beyond the ribs is the *gall bladder,* which empties by a narrow duct into the small intestine just beyond the stomach.

To the left of the stomach and also behind the ribs is another gland, which has no duct, called the *spleen;* it is dark colored and about the size and shape of the hand without the fingers.

Deeply placed behind the stomach and extending transversely across the abdomen is a slender tongue-shaped gland, the *pancreas* or *sweetbread* (Fig. 30). It is about six inches long by three-fourths of an inch broad, cream colored, and has a duct which terminates in the small intestine together with the common bile duct.

In the stomach the food which has already been masticated and part of the starch converted into glucose by the action of the saliva is brought into contact with the *gastric juice;* this juice is a sour liquid, containing pepsin and hydrochloric acid, secreted by the countless small glands found in the mucous lining of the stomach. This is the same pepsin and hydrochloric acid which are used outside the body to digest milk and other albuminates. The contraction of

the muscular walls of the stomach caused by the presence of food thoroughly mixes it with the gastric juice, and continues this churning motion as long as the food remains.

Under this process albuminates are partially converted into peptones, a form suitable for absorption, and part of these peptones are immediately absorbed by the capillaries of the stomach. The solution of the albuminous intercellular materials aids in the liquefaction of other food principles, which pass slowly out of the stomach into the intestine in the form of a whitish fluid known as *chyme*. The process of stomach digestion requires from one to four hours, depending upon the character of the food, the thoroughness of mastication, and other factors. Thus fish and chicken are more quickly digested than beef, and beef sooner than veal, baked and stewed meats sooner than the same articles fried.

The mucous lining of the small intestine is thrown into numerous folds known as *valvulæ conniventes*, the purpose of which is to increase the extent of surface and this is still further accomplished by the innumerable *villi* or tiny projections which stud the surface of the mucous membrane and give it a velvety appearance. There are also millions of small *glands* or *follicles* which secrete the *intestinal juice*, an important aid to digestion. Beside the intestinal glands we have already seen that the liver and pancrease empty their secretion into the small intestine at its upper part.

The *functions of the liver* are many; the most important are the production and storage of sugar, the production of urea, and the secretion of bile. The *bile* helps to emulsify fats, stimulates the intestinal muscle to contraction, acting as a laxative, and is a natural antiseptic preventing putrefaction of the intestinal contents. It is a familiar fact that when bile is absent from the intestine, as in some forms of jaundice, constipation and very offensive stools are apt to result.

The *pancreatic juice* digests all three classes of food, albuminates starches and sugar, and fats.

Unlike the gastric juice, it is alkaline and incapable of acting except in the presence of an alkaline reaction.

To digest foods outside of the body we now use pancreatin and soda almost to the exclusion of pepsin and acid.

Under the combined influence of all these intestinal juices the chyme is soon converted into a milky liquid known as *chyle*, and this

is absorbed by both the capillaries of the intestinal tract, whence it passes to the liver through the *portal veins,* and by the *lymphatics* or *lacteals,* another system of vessels which, arising in the *villi,* passes through a number of *lymphatic glands* situated in the mesentery and known as the *mesenteric glands,* to reach a large duct known as the *thoracic duct,* which passes up the left side of the spinal column and empties into the left subclavian vein, just before its junction with the left internal jugular.

The *spleen* has no direct part in digestion, but it does serve indirectly by acting as a reservoir for the storage, in the intervals of digestion, of the additional amount of blood needed during digestion. Other important functions of the spleen are the production of leucocytes, the destruction of erythrocytes, and the production of uric acid.

Passing on down the small intestine, the intestinal contents become more and more solid by the absorption of the liquid chyle, and this process is continued in the large intestine until finally the indigestible residue is cast out of the body as feces.

Some digestion and absorption do take place in the large intestine, as we know from what occurs when we use nutrient enemata, but the action is not a powerful one, and it is safer to give the enemata predigested.

When digestion is incomplete from any cause, putrefactive changes may occur in the undigested portion of food and the poisons resulting therefrom may be absorbed, giving rise to fever, headache, and other symptoms of auto-intoxication.

CHAPTER V

THE BLOOD AND THE CIRCULATORY SYSTEM

THE *circulatory system* includes the *lymphatic system* and the *blood-vessel system.*

The *lymphatic system,* or *absorbent system* (Fig. 31), includes the *lymphatic* and *lacteal vessels,* and the *lymphatic glands.*

FIG. 31.— Lymphatic System of Trunk, Genitals, and Upper Arm.

The *lymphatic vessels* are found in all parts of the body, wherever there are blood-vessels; they contain lymph, a colorless fluid like water, except those of the intestine, which during digestion contain a milky fluid, which gives to these particular lymphatics the name of

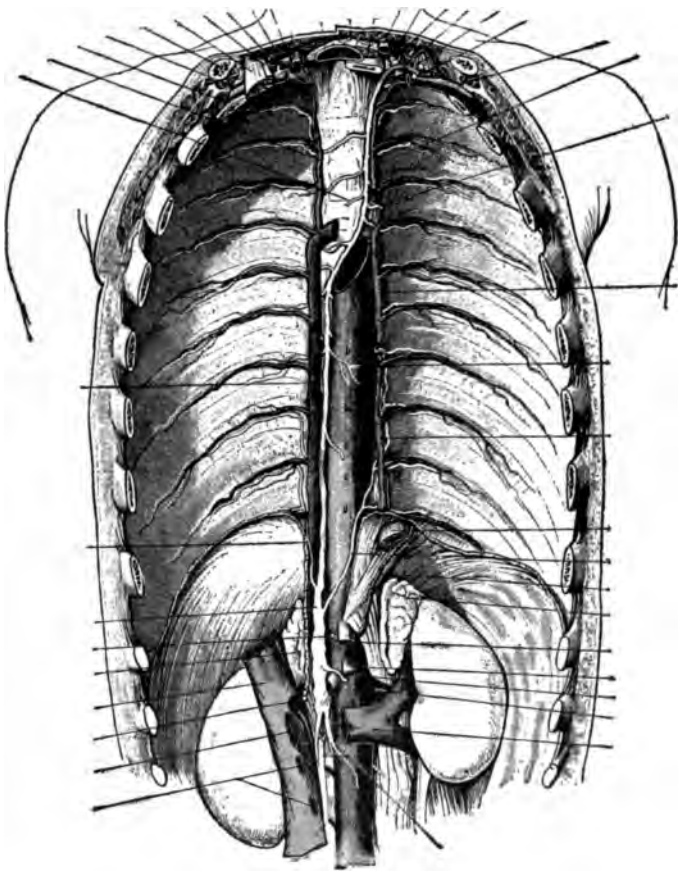

FIG. 32.— Thoracic Duct.

lacteals. All over the body also are found *lymphatic glands,* varying in size from a pin head to a small almond; all the lymph passes through these glands before it reaches the blood by way of the thoracic (Fig. 32) and lymphatic ducts. The lymphatic system has an important function in connection with the elaboration of the blood,

more and more blood cells appearing in the lymph as it passes through successive chains of glands.

The glands also serve a very useful purpose in resisting the invasion of the body by disease germs.

In the case of an infected finger wound, for instance, one sometimes sees fine red lines running up the arm and the patient complains of a *kernel* in the arm-pit; the red lines are inflamed lymphatics and the kernel is an inflamed gland; again, in the case of a sore on the penis the glands in the groin swell, constituting a *bubo*.

Certain groups of lymphatic glands are important owing to their connection with special diseases.

A characteristic of syphilis is an enlargement of the *inguinal, epitrochlear,* and *post-cervical glands,* found respectively in the groin, just above and behind the inner elbow, and at the junction of the neck with the back of the head.

FIG. 33.—*a, b, c, d,* Red cells, side, edge, in rouleaux, crenated; *e, f,* white cells.

The inguinal glands also become inflamed in other venereal diseases. The glands in the front of the neck become enlarged, cheesy, and sometimes suppurating in the condition commonly called *scrofula,* really a tuberculous invasion through the mouth.

The *functions of the blood* and *blood-vascular system* are to receive from the lungs and alimentary tract and to carry to all parts of the body the materials necessary for its nutrition and proper temperature and moisture, and to carry away to the excretory organs the waste matters which if retained would prove poisonous. It has also important functions in the protection of the body from the invasion of the bacteria of disease.

The total quantity of blood is usually estimated at one-twelfth of the weight of the body, or an average of about a gallon and a half.

The blood is red in color, bright red in the arteries, dark red in the veins. It is composed of *cells* or *corpuscles* floating in a liquid, the *liquor sanguinis.*

The cells are of two sorts, the *red cells* or *erythrocytes* and the *white cells* or *leucocytes* (Fig. 33). The red cells are much the more numerous, there being about five hundred times as many as there are of the white. They are very small, about one-three-thousandth of an inch in diameter, and, though red in mass, the individual cells are

seen under the microscope to be light yellow in color. They are round, flattened discs, like a copper cent, except that they are concave on each side, and are largely composed of ***hemoglobin,*** a substance which has a great oxygen-carrying capacity.

The leucocytes are not flat like a cent, but spherical like a ball, a little larger than the red cells, composed of protoplasm, and capable of changing their own form and of making their way through the unbroken walls of the blood-vessels.

The *liquor sanguinis* consists of *serum* and the elements of *fibrin;* when bleeding occurs the fibrin at once forms and the blood *coagulates* or *clots;* but for this property of the blood hemorrhages would never stop.

Serum, which is liquor sanguinis less fibrin, contains the principal nourishing ingredients of blood — albumin, fats, sugar, salts, and gases.

In a general way the blood current may be likened to a river and the cells to boats floating upon it; the red cells are the freight boats loaded with oxygen which they receive in the lungs and carry to all parts of the body; the white cells are the war ships, always on the alert for an attack by disease germs; when such an attack occurs the leucocytes hurry to the invaded point and a battle ensues in which there are killed and wounded on both sides; the dead white cells, when in large number, constitute *pus* or *matter.* The blood serum itself not only carries nourishment to all parts of the body, but, coming back, acts as a sewer, bringing away the waste products, both liquid and gaseous.

In order to maintain a constant circulation of the blood, a complete system exists, consisting of a constantly acting pump, the ***heart,*** the *arteries* which carry the pure blood to all parts of the body, the *capillaries* from which the blood delivers its nutritive materials to the tissues and takes on a load of waste products, and the *veins* which return the impure blood to the right side of the heart; this is the *systemic circulation* and requires about a half a minute for the entire trip; then there is a subsidiary system known as the *pulmonary circulation,* whose arteries take the impure blood from the right side of the heart to the lungs, in the capillaries of which it is purified, losing carbonic acid and waste matters, taking on a load of oxygen, and then passing through the pulmonary veins to the left side of the heart for another trip through the systemic circulation (Fig. 34).

The *heart* is a conical hollow muscle, situated between the lungs and behind the sternum and enclosed in a fibrous sack, the *pericardium* (Fig. 35). It is about the size of a closed fist, its average weight being three-fourths of a pound. The apex is found between the fifth and sixth ribs, just inside of the nipple line. It is divided

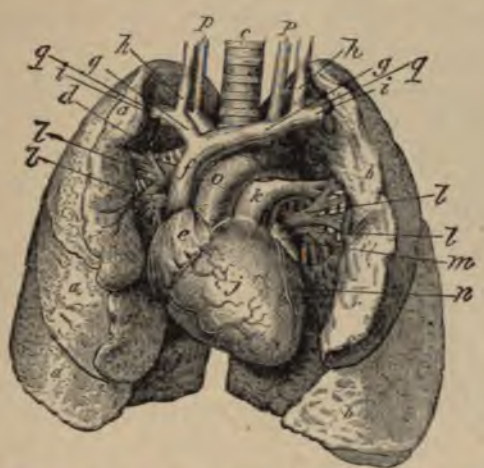

FIG. 35.—The Thoracic Organs. *a*, Right lung divided into three lobes, and *b*, left lung into two lobes, their anterior margins thrown back to expose the deeper parts; *c*, trachea, with its cartilaginous rings; *d*, right bronchial tube; *e*, right auricle, receiving from above, *f*, the superior vena cava, which is formed by the junction of *g*, *g*, the right and left innominate veins, and each of these by the confluence of *h*, *h*, *i*, *i*, the jugular and subclavian of its own side; *j*, the right ventricle, giving issue to *k*, the pulmonary artery, which divides into two branches, that for the right lung passing behind the other great vessels; *l*, *l*, *l*, *l*, pulmonary veins, bringing oxygenated blood to *m*, the left auricle; *n*, the left ventricle, from which the blood is carried to the organs and tissues by *o*, the aorta; *p*, *p*, *q*, *q*, carotid and subclavian arteries, given off from the arch of the aorta.

by a vertical partition into two lateral halves which have no communication with each other. Each of these lateral halves is further subdivided by a horizontal constriction into two communicating cavities, an *auricle* and a *ventricle;* the whole heart is lined by a smooth membrane, the *endocardium,* and all its openings are protected by *valves* (Fig. 36).

The right is the venous side of the heart; its auricle receives the venous blood from the entire body through the superior and inferior *vena cava;* when it is full it contracts and passes the blood into the right ventricle, which in its turn contracts and sends the blood to the lungs, whence it is returned arterialized to the left auricle, and

[illegible] the arteries to [illegible] beating of the heart takes [illegible] The valve between [illegible] as the mitral, that [illegible] valves which prevent [illegible] arteries are known as [illegible]

[illegible] The Heart

[illegible] arteries are elastic, [illegible] tubes, which stand [illegible] when cut across, and are [illegible] out valves except at their exit from the heart. The elastic tissue in their walls allows them to expand when blood is forced in from the heart, and by subsequent contraction to maintain a uniform pressure between heart-beats. It is this expansion, caused by the heart forcing more blood into the already full arteries, which constitutes the *pulse*. The muscular tissue allows of a local regulation of the circulation under nervous influences such as occur in blushing or the pallor of fear.

The arteries freely communicate with each other by the *anastomoses* of small branches so that when an artery becomes blocked by a clot or is tied the blood goes around the obstruction by means of the communication between the small branches given off on either side and the [illegible] is established. It is by reason of the freedom of the collateral circulation that both ends of a cut artery spurt and but for it gangrene might ensue when an artery is tied.

By the constant giving off of branches the arteries become smaller and [illegible] terminate in the capillaries.

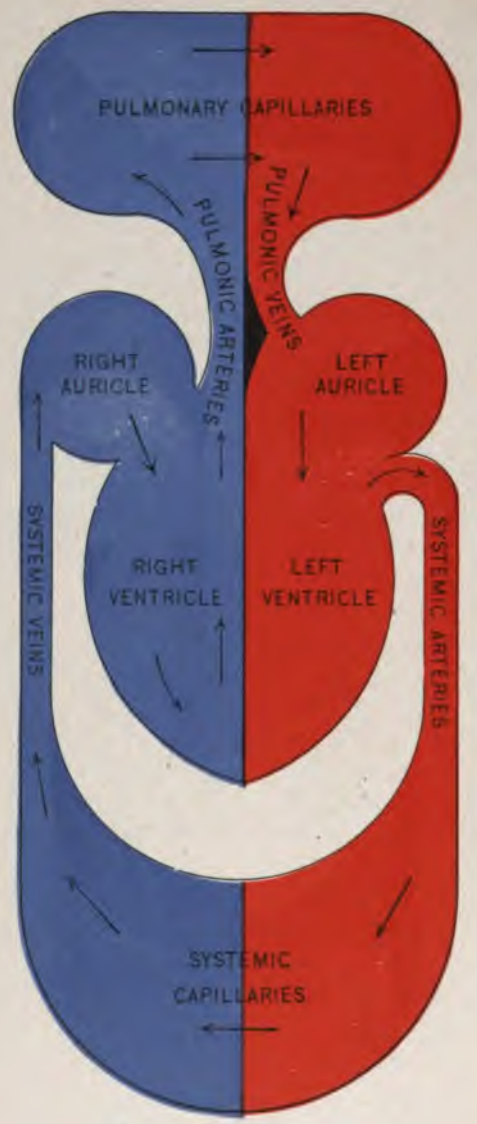

FIG. 34.

DIAGRAM TO SHOW THE COURSE OF THE BLOOD IN PASSING FROM A GIVEN POINT THROUGH THE TWO SETS OF CAPILLARIES TO THE STARTING POINT.

The *capillaries*, so called because of their resemblance to minute hairs, though they are much smaller than the finest hairs, differ from the arteries in being of a uniform size throughout, and in having only a single thin celular coat through which the ultimate interchange of materials takes place between the blood and tissues.

The smallest *veins* start from the capillaries and constantly join each other, growing larger and larger, until finally all the venous blood in the body enters the right side of the heart through the superior and inferior vena cava. The pulmonary veins, unlike other veins, return arterial blood from the lungs to the left auricle.

Veins differ from arteries in the following particulars: ***Veins:*** The contained blood is dark red; it flows in a continuous stream without spurting; it flows toward the heart. The veins have thin walls so that they collapse when cut across; bleeding occurs only from the far end of the cut vein, because the valves (Fig. 37) with which all veins (except those of the rectum) are supplied prevent a backward flow of blood from the near end. Many veins are supercial and may be seen under the skin.

FIG. 37.—The Valves of a Vein.

Arteries: The contained blood is bright red; it flows in waves, and spurts from the vessel when cut; it flows away from the heart. Arteries have thick walls and stand open when divided, like a piece of hose; bleeding occurs from both ends, owing to the absence of valves and the freedom of the collateral circulation. The large arteries are deeply placed near the bone and are usually on the inner or protected side of a limb. The circulation of the blood in the arteries is effected by the pumping action of the heart. In the viens the action of the heart is only one factor, the other two being pressure of the muscles in exercise and the aspirating power of the chest in inspiration. When the muscles contract they press on the thin-walled veins, and, as the blood is prevented from going backward by the valves, it must go toward the heart.

When any obstruction exists in the course of a vein it is apt to become enlarged or *varicose;* such enlargements we see in the leg, constituting *varicose veins,* in the scrotum, called *varicocele,* and about the anus, called *hemorrhoids* or *piles.*

All the arterial blood leaves the left ventricle of the heart by means of a large artery, called the *aorta* (Fig. 38); this vessel arches back-

ward over the root of the lung, to the left side of the spinal column, down which it passes to the fourth lumbar vertebra, where it divides into the *common iliacs.* From the *arch of the aorta* are given off three large vessels, the *innominate,* the *left common carotid,* and the *left subclavian;* the innominate soon divides into the *right common carotid* and *right subclavian,* so that at the root of the neck the two sets of arteries are symmetrical. The *common carotids* on each side pass up alongside the trachea, or windpipe, where they can be felt, to the upper border of the thyroid cartilage, or "Adam's apple," where they are divided into the *internal* and *external carotids.* The *internal carotids* supply the interior of the cranium; they lie just behind the tonsils on the inside of the throat. The *external carotids* supply the exterior of the cranium and face, and the tongue; the front edge of the sterno-mastoid muscle is the guide to this artery; the *external carotid,* or better, the *common carotid,* may be compressed against the vertebral column. The *facial,* a branch of the external carotid, curves over the lower jaw about an inch in front of its angle and can be compressed there; the *temporal,* another branch, passes up just in front of the ear and divides into an *anterior* and *posterior temporal branch.* The *superior* and *inferior coronary* branches of the facial unite with those from the opposite side to form a complete arch in each lip.

The *subclavian artery* passes across the rst rib just behind the clavicle, then beneath the clavicle to the axilla, where its name changes to axillary; in the hollow behind the clavicle the subclavian can be felt and compressed against the rib. The *axillary artery,* where it passes beyond the armpit, is caled brachial; the *brachial* extends from the lower margin of the axilla down the inner and anterior aspect of the arm, and terminates about a half inch below and in front of the bend of the elbow, where it divides into the *radial* and *ulnar.* The course of the brachial artery is roughly indicated by the inner seam of the coat sleeve, or by a line drawn from the armpit along the inner border of the biceps muscle to the front of the elbow; it may be compressed against the humerus.

The *radial artery* passes down the radial side of the arm to the wrist, where it winds around the outer side and then passes forward to the palm between the thumb and index finger; the *ulnar artery* in like manner passes down the ulnar or inner side of the arm and divides into two branches which anastomose with two similar

branches from the radial, forming the *superficial* and *deep palmar arches.* Both the radial and ulnar are deeply buried under the muscles until just above the wrist where they become superficial; it is at this point that the beating of the radial is felt for in taking the *pulse.* The position of the palmar arches is important, because, owing to the fact that they receive branches from both the radial and ulnar arteries, bleeding from them is profuse and requires for its control pressure on both vessels. The *superficial palmar arch* is on a line with the lower border of the extended thumb, while the *deep palmar arch* is a half inch higher up.

The *digital arteries,* which supply the fingers, are branches of the palmar arches and pass along both sides of each finger.

In the thorax the aorta gives off the *intercostals,* which run along the inner surface of the upper and lower borders of each of the ribs; in the abdomen it gives off important branches to all the abdominal viscera, and divides into the common iliacs. The *common iliac* on each side passes downward and outward to the margin of the pelvis where it divides into the external and internal iliac. The *internal iliac* goes to the interior of the pelvis and supplies it together with its viscera and the generative organs. The *external iliac* passes downward and outward to the fold of the groin, where it enters the thigh and becomes the femoral. The *femoral artery* commences at the center of the groin and passes down the front and inside of the thigh to the back of the knee, where it is known as the popliteal; its course may be shown by stretching a string from the center of the groin to the back of the knee; just below the groin it may be compressed against the head of the femur.

The *popliteal artery* extends from the termination of the femoral to just below the knee where it divides into the anterior and posterior tibial; it is so tightly held down under fascia and tendons that it is hardly accessible for compression. The *anterior tibial* passes forward between the tibia and fibula to the front of the leg and then down deeply beneath the muscles to the front of the ankle, where it becomes the *dorsalis pedis* which is distributed to the back of the foot. The *posterior tibial* gives off a large branch, the *peroneal,* and then passes down the back of the leg beneath the deep muscles to the inner ankle, whence it passes to the sole of the foot and divides into two branches, the *internal* and *external plantar,* which supply the toes with *digital arteries* having the same distribution as those of

the fingers. Behind the inner ankle the posterior tibial may be felt and compressed.

The veins may be divided into three sets, the *pulmonary*, the *systemic*, and the *portal*.

The *pulmonary veins* differ from all others in that they convey arterial blood from the lungs to the left side of the heart; conversely, the *pulmonary artery* conveys venous blood from the right ventricle of the lungs.

The *systemic veins* (Fig. 40) are arranged in two sets, deep and superficial; the *deep veins* accompany their corresponding arteries, each of the large arteries of the leg, forearm, and arm having two veins; the deep veins communicate with the superficial set. The *superficial veins* lie just under the skin where they can, in many localities, be plainly seen; those of the lower extremity are the *internal saphenous*, which starts on the top and inner side of the foot, runs up the inside of the leg and thigh and terminates in the femoral just below the groin, and the *external saphenous* starting in like manner on the outer side of the foot and emptying into the *popliteal* behind the knee.

Those of the upper extremity are the *radial* on the outer side, the *ulnar* on the inner side, and the *median* in the middle; opposite the bend of the elbow the median splits into two veins, the one, known as the *median cephalic*, joining with the radial to form the *cephalic*, and the other, the *median basilic*, uniting with the ulnar to form the *basilic*; the basilic and cephalic both empty into the *axillary*. The *median cephalic* is the vein ordinarily opened in bleeding. The great superficial vein of the neck is the *external jugular*, which passes down from the angle of the jaw to the middle of the clavicle; it may be brought into view by pressing with the finger just above the middle of the clavicle.

The *portal system* is composed of four large veins which collect the venous blood from the viscera of digestion. The trunk formed by their union (*vena porta*) enters the liver and breaks up into capillaries from which another set of veins, the *hepatic veins*, arise, which terminate in the *vena cava*. This circulation is for the purpose of subjecting the products of digestion contained in these veins to the special action of the liver before they go into the general circulation.

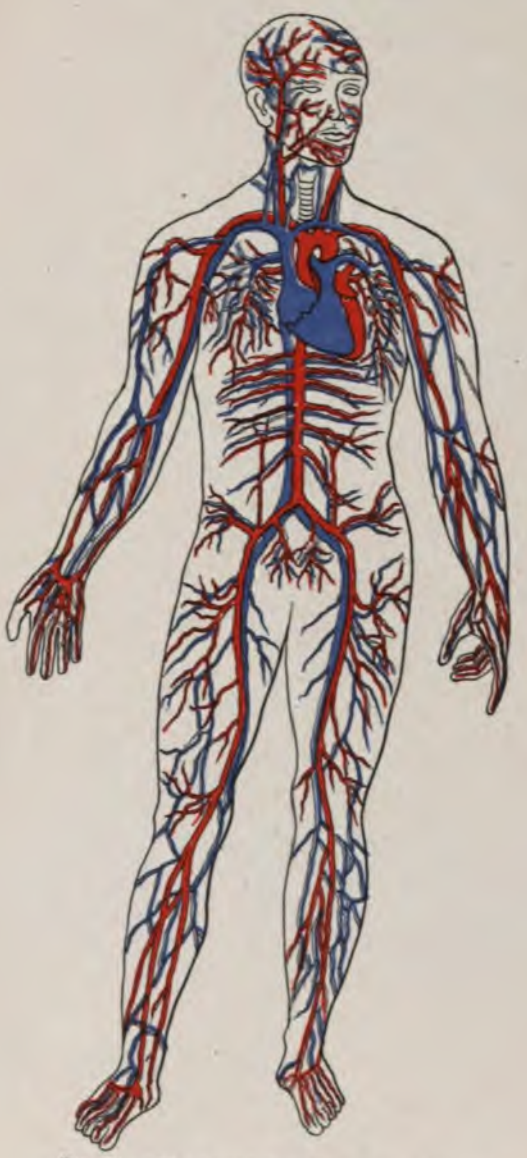

FIG. 38. — The Circulation, Venous and Arterial.

CHAPTER VI

THE RESPIRATORY APPARATUS

THE respiratory apparatus consists of the larynx, trachea, bronchi, and lungs; the thyroid gland, which lies upon the trachea, may be conveniently considered in this connection (Fig. 39).

The *larynx*, or *Adam's apple*, is the organ of voice, and is situated in the middle line of the neck, where it may be felt and seen moving up and down in the act of swallowing. It lies between the trachea and the base of the tongue, and its upper opening is closed during swallowing by a cartilaginous flap called the *epiglottis;* when the tongue is drawn well forward, especially if the patient gags, the epiglottis may be seen as a white cartilage curving forward over the root of the tongue. When one chokes in swallowing because the food is said to have "gone the wrong way," it means that the epiglottis has failed to close efficiently the opening into the larynx, and food has gotten in, causing coughing for its expulsion.

The larynx is composed externally of cartilage; internally two white fibrous bands stretch from front to rear, and are known as the *vocal cords;* it is the vibration of these vocal cords that produces sound.

The *trachea* or *windpipe* is a cartilaginous and membranous tube which extends downward about four and one-half inches from the larynx to its division into the two *bronchi,* one of which goes to each lung. The cartilages of the trachea and bronchi are arranged in rings, and serve the purpose of keeping the windpipe open. The *right bronchus* is larger and shorter than the left, and foreign bodies which get into the windpipe usually lodge in this bronchus.

The bronchi divide and subdivide and give off branches like a tree, at the same time gradually losing their cartilages and getting thinner and thinner until the little bronchioli terminate in a sack the walls of which are studded with *air cells,* a terminal bronchus and its air cells resembling a bunch of grapes.

The termination of the bronchi together with the air cells constitutes the lung tissue proper.

When the larynx becomes obstructed by disease so that air cannot

get into the lungs and death is otherwise imminent, a tube is introduced into the larynx between the vocal cords, ***intubation***, or an opening is made into the trachea and a tube inserted there, ***tracheotomy***.

The ***lungs*** are the essential organs of respiration; they are commonly known as "lights," and with the heart between them fill the entire chest cavity (Fig. 35). Each is covered by a smooth, shining ***serous membrane*** which also lines the chest cavity and is called the ***pleura***. Ordinarily the lungs are everywhere in contact with the chest walls, but when an opening is made in the chest, as by a shot or stab wound, or when inflammation of the pleura occurs and fluid is poured out, a space is formed between the lung and the chest wall, known as the ***pleural cavity*** (Fig. 40).

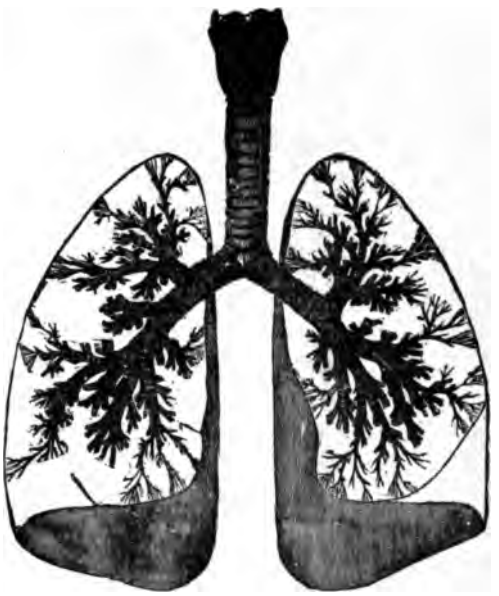

FIG. 39.—The Larynx, Trachea, Right and Left Bronchus, and the Lungs. The latter have been cut open to show the method of division and subdivision of the Bronchi.

The right lung has three lobes, the left lung two, and each is composed of bronchi, air cells, and the divisions and subdivisions of the pulmonary arteries and veins.

In the ultimate air cells the venous blood of the pulmonary arteries circulating in the capillaries is brought in contact with the air in the cells, and the interchange takes place which results in the blood receiving a supply of oxygen and becoming arterial, while the air becomes charged with carbonic oxide, waste organic matter, and watery vapor.

In inflammation of the lungs, ***pneumonia***, these air cells become filled with liquor sanguinis containing some red blood cells, so that air can no longer enter and that portion of the lung is temporarily useless. In *laryngitis* and *bronchitis* mucus is poured out into the

bronchi and coughed up, but the air cells are free; hence those affections are much less serious.

Breathing or *respiration* consists in the alternate expansion and contraction of the chest, by which air is drawn in and forced out; the drawing in is known as *inspiration* and the forcing out as *expiration*. The number of these movements in health is about eighteen to the minute. In ordinary quiet respiration the principal muscle concerned is the diaphragm, which in its relaxed state is arched upward into the cavity of the chest; in its contraction the muscle is flattened out, largely increasing the capacity of the chest, so that the air rushes in through the larynx to fill the vacuum; inspiration completed, the diaphragm relaxes, the chest walls collapse, and expiration occurs. When respiration becomes more active the intercostal muscles, which raise the ribs, come into play, and when still more effort is required all the muscles attached to the chest come into action, and even the nostrils are dilated to allow the entrance of more air.

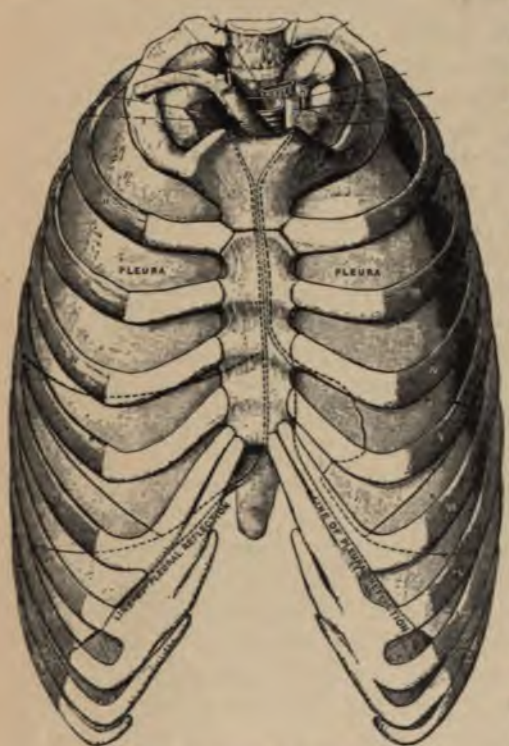

FIG. 40. — Chest, showing Pleuræ.

Ordinary outdoor air contains about twenty-one parts of oxygen, seventy-nine parts of nitrogen, and four hundredth parts of carbonic acid, or four parts in ten thousand.

The *oxygen* is the element of the air which is necessary to sustain life; it serves the same purpose as it does in a fire, maintains the

combustion by which heat and force are produced. If you shut off the supply of air (oxygen) to a furnace the fire goes out; if you shut off the supply to the lungs life goes out. The nitrogen has no other value than to dilute the oxygen.

When air is breathed it loses a portion of its oxygen, is raised in temperature, and has added to it in the lungs carbonic acid, organic matter, and the vapor of water; the amount of contained carbonic acid is increased a hundred times, to about four per cent.

As the air in a confined space is breathed over and over again, headache and drowsiness are experienced, and even death may result.

A notable instance of this character occurred in India in the year 1756, when one hundred and fifty-six British prisoners were confined in a dungeon eighteen feet square; the next morning one hundred and twenty-three of them were dead.

The causes of these results were formerly supposed to be deficiency of oxygen, increase of carbonic acid, and organic matter. Now we believe that the real causes are increased temperature and humidity, and stagnation of the confined air; just how these factors act, we do not know, but experience has demonstrated that when the air is kept in motion, and the temperature reduced, the unpleasant symptoms do not occur.

The inflow of fresh air to take the place of that which has been breathed is known as *ventilation*.

The heat which is produced in the body by the burning or oxidation of carbon, the resulting carbonic acid escaping through the lungs, would raise the temperature of the body too high were it not that provision is made for its regulation. The evaporation of water is the principal cooling agency, the evaporation taking place from the lungs and skin; this is going on all the time, though the vapor from the lungs is only visible in cold weather. So with the skin, the water is only visible in hot weather, when so much escapes that the unevaporated portion becomes visible as *sweat* or *perspiration;* the harder we work, the more heat is produced, and the more evaporation of water is required to reduce the body temperature. If the skin stops action the body temperature rapidly rises, and we have the condition of *heat stroke,* in which the hot, dry skin is a familiar symptom.

CHAPTER VII

THE EXCRETORY APPARATUS

WE have already seen that in all life processes waste products and poisons are produced, which, if not gotten rid of, are finally fatal even to the life which produced them. The yeast fungus growing in sugar solution produces a poison, alcohol, which when it reaches a certain proportion destroys the life of the yeast; so with the human body, it produces very deadly poisons which must be thrown off if the body would live, and the apparatus by which these poisons are eliminated is known as the excretory apparatus. The skin, lungs, large intestine, and urinary apparatus all take part in excretion.

The excretory functions of the skin, lungs, and rectum have been fully described elsewhere. It remains to give a description of the *urinary apparatus,* whose practically sole function is excretion. It consists of the *kidneys* which secrete the urine and the *ureters* which convey it to the *bladder,* where it accumulates until it is convenient to discharge it through the *urethra.*

The *kidneys* (Fig. 32), one on each side, are situated in the loins, at the back of the abdomen, behind the peritoneum, on either side of the spinal column, and just below the last rib. They are about four inches long by two and a half inches wide, by one and an eighth inches thick, and weigh about five ounces each. They are covered by a fibrous capsule which may be stripped off, and consist of two portions, a cortex and a medullary portion. The *cortex* is the secreting part, while the *medulla* is largely an aggregation of urinary tubules on their way to the pelvis of the kidney.

Each *urinary tubule,* after many twists and loops, terminates in a little sack, in which is a bunch or tuft of tortuous capillaries; the veins emerging from these capillaries are smaller than the arteries that empty into them, so that the blood in passing through is subjected to some degree of pressure, and under the pressure water and salts escape from the vessels. Farther on down the tubule the secreting epithelium with which the tubule is lined takes from the

blood the urea and other waste products necessary to purify it and complete the urine.

On the inner side of each kidney is a deep depression containing a funnel-shaped sac, the *pelvis*, which receives the terminations of the urinary tubules, and is itself the starting point of the ureters. The *ureters* are two musculo-membranous tubes, about the size of a goose quill, and sixteen inches long, extending from the pelvis of the kidneys to the urinary bladder (Fig. 41).

When a stone formed in the pelvis of the kidney finds its way into one of these ureters, in its passage to the bladder, it naturally has a hard time in getting through such a small canal, and the result is the excruciating pain experienced in such a condition which is known as *renal colic*.

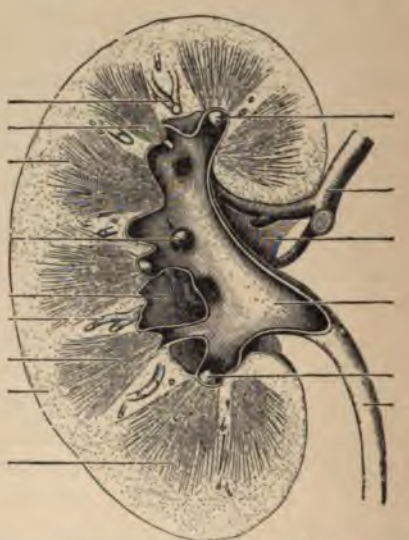

FIG. 4. — Section of the Kidney. *A*, Cortex; *B*, medulla; *C*, pelvis; *D*, ureter.

The *bladder* is a muscular bag which serves as a reservoir for the urine and in a moderately distended condition holds about a pint. When empty or containing only a small amount of urine it lies wholly within the pelvis, and behind the pubis; when full it rises into the abdomen and can be felt and percussed above the pubis. To determine whether the bladder is full we tap on the finger placed just above the pubis; if we get a hollow sound we know that it cannot be distended (Fig. 42).

As the bladder rises into the abdomen it leaves exposed in front a small area not covered by the peritoneum and through which it can be aspirated without opening the peritoneum. Likewise there is a similar area behind, where the bladder rests on the rectum and through which it can be reached. The neck of the bladder is embraced by the *prostate gland* which in old men becomes enlarged and makes a bar to the passage of urine.

The *urethra* is eight or nine inches long and extends from the neck of the bladder to the *meatus:* when the penis is held up that portion of the urethra under the pubis describes a curve with the concavity upward, hence the curved shape of catheters and sounds.

Urine is a watery solution of urea, uric acid, coloring matter, and salts, mostly urates, phosphates, carbonates, and chlorides. The

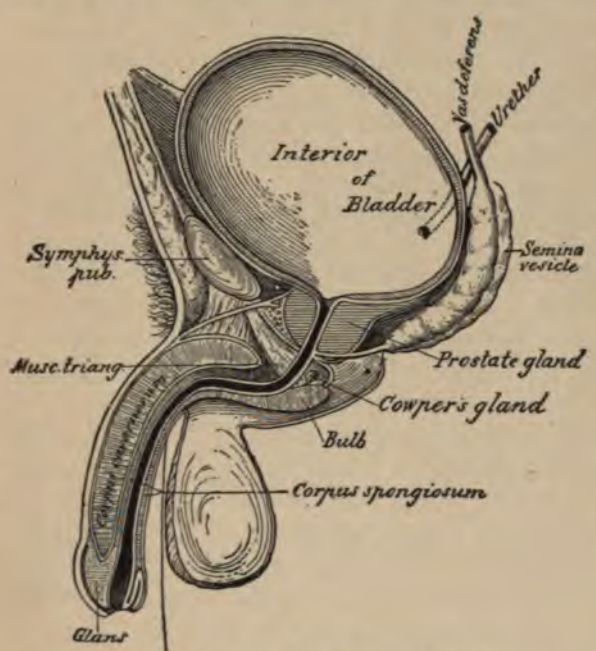

FIG. 42.— Section of Bladder and Urethra.

average man passes about fifteen hundred cubic centimeters or three pints of urine a day, and this urine contains about fifty grammes or one and one-half ounces of solids. Normal urine is yellowish in color, acid in reaction, and has a specific gravity of from 1015 to 1025.

The *urea* is the most important constituent, a little more than an ounce being excreted daily.

Healthy urine when passed is ordinarily clear, but it may quickly become cloudy and a sediment form without indicating disease. If such cloudiness disappears when the urine is heated it is due to

urates; if the cloudiness disappears on the addition of a few drops of acid it is due to *phosphates.*

Among abnormal constituents of the urine, indicating disease, are albumin, sugar, bile, blood, and pus.

Just above the kidney on each side is a small triangular ductless gland known as the *suprarenal gland.* It has nothing to do with the excretion of urine but is considered here for convenience. That these little glands add something important to the blood is shown by the fact that their removal in animals is quickly followed by death, and that their diseased condition in man is the cause of a fatal malady known as *Addison's disease.* Their function appears to be to sustain muscular tone, especially in the blood-vessels, and a substance known as *adrenalin* has been isolated from them which has a very powerful effect in that direction.

PART III

FIRST AID

CHAPTER I

EMERGENCIES, CONTUSIONS, AND WOUNDS

ONE of the most important of the many duties of the hospital-corps man is to render first aid; in time of war it becomes his most important duty. In order that this duty shall be performed promptly and efficiently and without excitement or hesitation he must be taught what to do until he possesses the confidence born of knowledge.

If called upon for assistance in an emergency under other conditions than those of an action his first duty is to send word to a medical officer; in action this often can not be done. The next step is to see that the sick or injured man is not crowded about so that he can not get air; then the nature of the case must be ascertained as quickly as possible. Look for bleeding; if it is at all profuse it must be stopped at once; if there is shock lower the head and give a little aromatic spirits of ammonia in water; if there is a wound protect it by a first-aid dressing, ripping up the clothing if necessary to get at it, but not attempting to clean or handle it in any way; if there is a fracture immobilize it before moving the patient a foot, so that a simple fracture may not be made compound. Then remove any equipments the soldier may have on, unbutton his collar, and loosen the clothing about his chest and abdomen.

In action the amount of first aid to be rendered will depend on circumstances; perhaps the arrest of severe hemorrhage is all that can be attempted.

The clothing must be preserved as far as possible, for it is often impossible to replace it. On reaching the hospital the clothing must be very gently removed. To remove a shirt, pull it up from the back,

then draw it over the head to the front, and lastly disengage the arms; if one arm is injured disengage the well arm first, then draw the shirt over the head, and lastly free the injured arm; if necessary rip up the seam on the injured side.

A *contusion* or *bruise* is a subcutaneous or closed wound: a laceration of the deeper tissues without a division of the skin. Contusions vary in extent from an ordinary "black and blue" spot, to the almost complete pulpification of a limb with laceration of the blood-vessels and nerves such as sometimes occurs in railway or other accidents. The first evidence of contusion is usually rapid swelling of the part; every one knows that when one is struck a hard blow on the eye the swelling closes it almost immediately, or a blow on the head is promptly followed by a "bump." There is only one thing which could cause such rapid swelling, and that is bleeding caused by the laceration of the subcutaneous tissues and vessels, the blood not being able to escape. At first there is no discoloration, but after a few hours or a day, the blood makes its way toward the surface, and the part looks black and blue and, as changes later take place in the blood, greenish or yellow. Another symptom is pain. If the injury is severe there is shock; the more shock the less pain usually. *Shock* is a condition of nervous depression like fainting, only shock is due to physical causes, while fainting is due to mental impressions. The symptoms of shock are anxiety, pallor, dilated pupils, trembling, chilly feeling, nausea, clammy skin, very weak pulse, sighing respiration, often a subnormal temperature. The amount of shock will depend upon the part of the body injured and the gravity of the injury; it is much more marked in injuries of the trunk than in injuries of the extremities; injuries of the testicle are apt to be attended with marked shock. Shock may be so severe as to terminate fatally without reaction.

The treatment of shock consists in the use of heat externally and stimulants internally; hemorrhage must be carefully looked for and controlled if present. In severe shock on the field it is often safer not to attempt to move the patient until there are signs of reaction; give him some stimulant and leave him temporarily. If he can be moved get him in bed as quickly as possible; wrap him in hot blankets and surround him with bottles of hot water; give him hot coffee or hot beef tea; keep him perfectly quiet with the head low.

For the treatment of the contusion itself the indication is to stop

the subcutaneous bleeding; this can be done by very hot or very cold applications; if the injury is in a limb, firm, even pressure of a bandage may be effective. Later when the bleeding has ceased the absorption of the extravasated blood may be hastened by hot fomentations and massage.

A *wound* is a division not only of the tissues but of the overlying skin. Wounds are classed as *incised, lacerated, contused, punctured,* and *poisoned; gunshot wounds* are usually considered in a class by themselves.

An *incised wound* is one made with a sharp cutting instrument, the class of wounds commonly known as *cuts,* such as cuts with a razor or knife.

A *lacerated wound* is a *torn* wound, such as is made by barbed wire or a piece of shell; it does not differ practically from a *contused* or *bruised* wound made with a blunt instrument such as a club or stick.

A *punctured* wound is deep and narrow; stabs are punctured wounds.

A *poisoned wound* is one in which some poison has been introduced by the same agent which made the wound; any of the above-named classes of wounds may be poisoned.

Gunshot wounds are both punctured and contused; they may also be lacerated.

Incised wounds are especially apt to be attended by bleeding; lacerated and contused wounds are less apt to give rise to dangerous hemorrhage because the vessels are torn and twisted; a limb may even be entirely torn off without serious bleeding, but shock in this class of wounds is apt to be severe.

Punctured wounds are dangerous because, while the external opening may be small, they often penetrate so deeply as to seriously injure important organs, or cause internal hemorrhage.

The immediate dangers of wounds are hemorrhage and shock; if these are removed the one great danger is *infection;* if that can be prevented the most serious wounds may be recovered from unless of course there is irreparable injury to some important organ.

The healing of wounds takes place in two ways; if there is no infection and no loss of tissue and the parts are brought into proper apposition healing occurs by *first intention;* otherwise by *granulation* with or without *suppuration.*

Most incised and small-arm bullet wounds are originally aseptic or germ free, and if kept so will heal or grow together under one dressing, without heat, redness, severe pain or swelling, and without fever. The bullet itself after it has lodged is usually harmless and may be ignored as far as the treatment is concerned.

If the wound becomes infected with pus cocci, *inflammation* occurs with its attendant symptoms of heat, redness, pain and swelling, and usually more or less fever; suppuration follows, and if the pus cannot escape freely some of the poisons produced by the growth of the pus cocci are absorbed, *septic toxemia,* or the cocci themselves get into the blood-vessels, *septic infection;* the septic infection may result in the formation of abscesses in the different parts of the body, *pyemia.* All these blood poisonings are attended by chills, or chilly feelings, fever, headache, a peculiar waxy appearance of the skin, and perhaps delirium and stupor. Unless arrested the process terminates in death.

Recent war experience, with its constant trench fighting, has shown that under the new conditions many wounds, especially those caused by shrapnel, shell, and hand grenades, are primarily infected, and not only with the bacteria of suppuration but often with those of gas-gangrene and tetanus. If infected with the germs of gas-gangrene, the wound quickly becomes foul and sloughy, and full of gas, so that it crackles under pressure.

The first-aid treatment of wounds consists in the arrest of hemorrhage — and by hemorrhage must be understood serious bleeding, and not the moderate bleeding which accompanies most wounds and only requires the pressure of a dressing — the relief of shock and the prevention of infection.

To prevent infection is all-important and may be accomplished by following a few simple rules: do not touch the wound with the fingers or anything else; do not attempt to wash it or remove particles of dirt or clothing; if the intestine is protruding do not attempt to replace it; if the sharp end of a broken bone is sticking through leave it undisturbed; remove the soiled and bloodly clothing about the wound, paint the wound and surrounding skin with tincture of iodine, allow it to dry, and apply the contents of the first-aid packet, handling the gauze with the waxed paper so as if possible not to touch any part of the dressing with the fingers.

Each soldier in the field is issued a *first-aid packet* for his in-

dividual use; it has a hermetically sealed metal cover, and contains two compresses of absorbent sublimated gauze, each sewed to the center of a sublimated-gauze bandage, each bandage being wrapped in parchment or waxed paper and two safety pins wrapped in waxed paper.

The first-aid packet is carried by all officers and enlisted men.

To protect the extensive wounds often caused by shell fire the ordinary first-aid packet is not large enough, so that these packets are now supplied in two sizes.

The larger or "shell-wound dressing" is wrapped in tough paper with directions for application printed thereon, and each contains 1 square yard of absorbent sublimated (1:1,000) gauze so folded as to make a pad six by nine inches, stitched to the back of each end of this compress is a piece of gauze bandage three inches wide by forty-eight inches long. The dressing also contains one absorbent sublimated-gauze bandage three inches wide by five yards long, and two safety pins.

If a first-aid packet is not at hand, the dressing may be of ordinary sterilized gauze, or any other thoroughly clean material, dry if possible.

Wounds of the skull if penetrating are usually accompanied by injury to the brain which will be manifested by unconsciousness, paralysis, unequal pupils, etc. No special first-aid treatment is required.

Wounds of the chest if penetrating are usually attended by injury to the lungs. The signs of penetration of the chest cavity are the presence of air bubbles in the wound, difficult breathing, cough, and spitting of blood. The treatment consists in laying the patient on the injured side and firmly bandaging the chest.

Wounds of the abdomen may or may not be penetrating, and there may or may not be injury to the viscera. The signs of injury of the intestine are the escape of gas or feces through the wound and the passage of blood in the stools.

Injury to the stomach may be attended with the escape of its contents and by vomiting of blood. No special first-aid treatment is required in these conditions, except that the patient should be placed in such a position as may favor the escape externally of the contents of the intestinal tract.

Injury of the bladder is shown by the escape of urine through the

wound and the passage of blood in the urine; if these signs are present the urine should be drawn frequently to prevent its escape into the abdomen.

In all cases of injury to the abdominal viscera the signs of shock are usually well marked.

Poisoned wounds may be divided into those in which the poison is chemical, including the bites and stings of insects, scorpions, tarantulas, centipedes, and snakes; and those in which it is bacterial, including the bites of man and other animals not rabid, the bites of rabid animals, and wounds infected with *tetanus* or *anthrax*.

The bites and stings of insects cause considerable smarting and if in loose tissues often much swelling; relief may be afforded by the application of ammonia, soda, or even wood-ashes; the sting if left in the wound should be extracted. *The bites of the tarantula and centipede* and the sting of the *scorpion* may cause great pain, considerable shock, and much local swelling and inflammation, but are seldom or never fatal. The treatment is the same as for the bites of other insects, but in very severe cases it may be necessary to incise the wound and suck out the poison. Stimulants may be given if necessary and morphine for the pain.

When a person is *bitten by a poisonous snake*, of which the rattlesnake and copperhead are the principal varieties in this country, prompt action is required.

If the wound is in the extremity tie a bandage or handkerchief tightly about the limb above the wound; incise the wound freely and suck out as much of the poison as possible; then with a hypodermic syringe inject a two-per-cent solution of permanganate of potash into and about the bite so as to destroy any poison which is left. If a hypodermic syringe and permanganate solution are not available, the bite should be cauterized with a lighted match, a hot coal, or a little gunpowder rubbed in and ignited. Meanwhile give stimulants freely but not to the point of intoxication. The ligature should be loosened about every half-hour so as to allow restoration of the circulation, but should be immediately tightened up if symptoms of general poisoning occur.

The bites of man and other animals not rabid are always more or less poisonous from the presence of the bacteria constantly found in the mouth and on the teeth; sometimes they are fatal; such wounds should be thoroughly disinfected and wet antiseptic dressings applied.

Rabies or hydrophobia is a very fatal disease caused by the bite of a rabid animal or "mad dog." The effect is not immediate like that of snake bite, but may be delayed weeks or months.

The treatment of the bite when the animal is known to be rabid is exactly like that of snake bite, but no ligature need be used.

Tetanus or lock-jaw is a disease the result of a wound infected by the bacillus of tetanus. It is especially apt to occur after toy-pistol wounds or any wound in which dirt has been carried deeply into the tissues. It has been very common in wars where the fighting occurs in trenches made in cultivated fields which have been enriched with stable manure.

The tetanus germ grows best in the absence of air; hence it thrives in deep, punctured wounds. The germs are found in the soil especially about gardens, stables, and in the streets. Wounds of such a character should be opened up freely, disinfected, and drained. If available, tetanus antitoxin should be injected into and about the wound.

Anthrax or malignant pustule is sometimes caused by the bite of an infected fly. It starts as a very hard swelling like a carbuncle, often on the lip. If its nature is recognized it should be at once excised.

In warfare with savage peoples the latter often used *poisoned weapons*, especially arrows. Many different poisons are used, vegetable, animal, and bacterial.

The local treatment is the same as that of snake bite; the general treatment must be symptomatic, unless the nature of the poison is known.

CHAPTER [illegible]

[illegible]

[illegible] there is a steady oozing of red blood from [illegible] method of arresting such a [illegible] of the blood in the [illegible] the contraction of their cut ends. [illegible] The part should be elevated and [illegible] applied to the wound; the effect of either [illegible] the result being the contraction of the [illegible] and arrest of hemorrhage.

[illegible] pressure applied to the wound by means of a [illegible] and bandage is all that is required.

[illegible] is a form of capillary hemorrhage which [illegible] the arms should be held by an [illegible] the head and a sponge dipped in cold water [illegible] the neck between the shoulders, and another [illegible] water should be [illegible] the nose. If this fails an astringent should be added to [illegible] and. Should the bleeding still continue, [illegible] with absorbent cotton; out of the blood then runs [illegible] from the back of the nose, the assistance of a surgeon [illegible]

[illegible] bleeding from a tooth socket is sometimes excessive; [illegible] with a narrow strip of gauze, place a compress over [illegible] and bandage the lower jaw firmly against the upper.

[illegible] there is a rapid flow of dark blood, a welling [illegible] without any spurting. In the treatment the first step [illegible] so little velocity is there in the venous current [illegible] will often stop the bleeding; if it does not, [illegible] be made directly over the wound, and hot or cold [illegible] applied if necessary; if in an extremity, the limb should [illegible] from the toes or fingers up to the bleeding point, in [illegible] pressure over the point.

In *arterial hemorrhage* the blood is bright red in color and escapes in jets. Nature's method of arresting such a hemorrhage is by the formation of a clot, the contraction of the muscular coat of the artery lessening the caliber, and the retraction of the middle and inner coats affording an obstacle to the escape of the blood and favoring clot formation, and the diminished force of the blood flow caused by the weakening of the heart's action, the result of the hemorrhage.

When fainting follows the loss of blood the hemorrhage often ceases at once because the heart's action is so weak that it cannot force out the clot which forms in the mouth of the vessel; in such a case, however, the bleeding is apt to start again when reaction takes place, or when some sudden movement displaces the clot. The recurrence of bleeding with reaction is known as *intermediate hemorrhage* to distinguish it from *primary hemorrhage*, that which occurs immediately on receipt of the wound, and *secondary*, that which occurs at a still later period from the reopening of the artery by the slipping of a ligature, or from an extension of sloughing or ulceration to the vessel.

Fig. 43. — Compression of the Femoral Artery.

In the *treatment of arterial hemorrhage* prompt action is required; bleeding from a large artery like the femoral may cause death in a minute or two; as a matter of fact a large proportion of the deaths on the battlefield are due to hemorrhage.

The thing to be done is to compress the artery between the wound and the heart, or if that cannot be done then in the wound itself; the point selected for pressure should be where the artery crosses a bone because there it can be made most effective. If a hose connected with a hydrant breaks we stop the flow of water by putting a foot

upon the hose between the broken part and the hydrant; we apply the same principle in arterial hemorrhage. The pressure should be made with the fingers, preferably the thumbs, and should be firm enough to arrest the bleeding (Fig. 43); it should be made over the clothes, as too much time may be lost in removing them. You will know that you are pressing on the right place by feeling the artery beating beneath the fingers and by the arrest of the bleeding; if you cannot find the artery make pressure directly over the bleeding point. As pressure with the fingers soon becomes tiresome, get an assistant to slip his thumb over yours, and take your place while you prepare a *tourniquet*. The principle of all tourniquets is a pad over the artery to bring the pressure on the artery and take it off the veins, a band around the limb and over the pad, and some means of tightening the band. There are a number of special tourniquets, but as they are not usually at hand a suitable one must be improvised; an excellent tourniquet may be improvised with a rubber bandage; a number of turns are made about the limb and the rolled portion of the bandage then placed under the last turn in such a position as to press directly upon the artery (Fig. 44). The most common improvised tourniquet is the *Spanish windlass;* in this arrangement any rounded, smooth, hard object, such as a stone, a cork, or a roller bandage, is used as a compress; for the band a handkerchief, a suspender, a waistbelt, a bandage, or anything of the sort may be used; to tighten up the band a stick or bayonet, scabbard or something of the kind is passed under the band and twisted until the

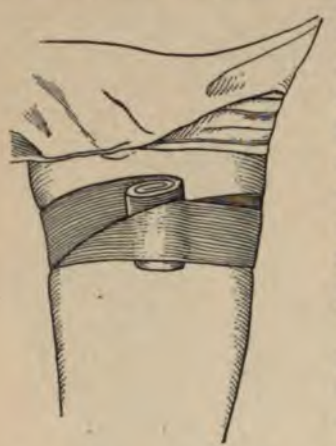

Fig. 44. — Compression of the Femoral Artery by a Rubber Bandage.

Fig. 45. — Spanish Windlass.

bleeding ceases, when the ends of the stick are tied to the limb to prevent the band from becoming untwisted (Fig. 45). A tourniquet applied tight enough to stop arterial hemorrhage causes pain and swelling of the limb, and if left long enough may cause gangrene of the part; it should therefore be watched and loosened up from time to time, say every half-hour or so. If on loosening the tourniquet the bleeding starts again tighten it up; if there is no appearance of bleeding leave the loose tourniquet in place with an attendant watching to tighten it up should the hemorrhage recur.

The surgeon arrests the hemorrhage permanently by tying or twisting the divided ends of the artery.

Fig. 46 shows on the skeleton the points at which the various arteries may be compressed to the best advantage.

For bleeding anywhere in the upper extremity below the middle of the arm compress the brachial in the manner shown in Fig. 47 and then apply a tourniquet a little higher up. If the wound is

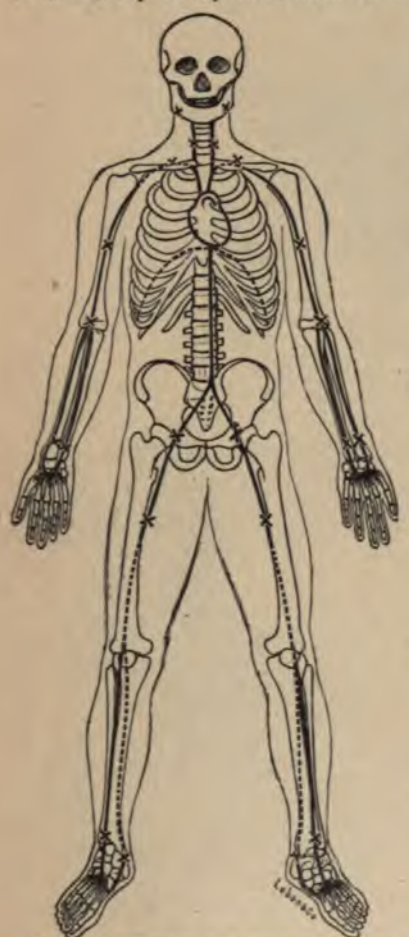

FIG. 46.— Skeleton with Black and Dotted Lines Showing the Course of the Arteries and a × Indicating the Pressure Points.

FIG. 47.— Compression of the Brachial Artery.

low down in the palm of the hand, it may not be desirable to arrest the circulation in the entire limb, in which case the pressure may be made in the palm by a roller bandage over which the fingers are doubled and tied in place with a bandage (Fig. 48); or we

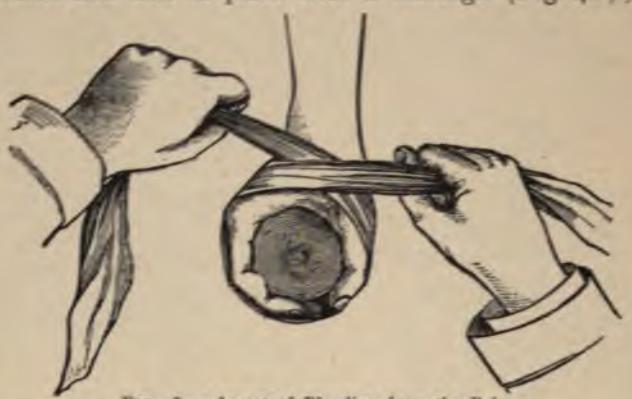

FIG. 48. — Arrest of Bleeding from the Palm.

may put a pad in the elbow and bend the forearm on the arm and tie the two together (Fig. 49).

If the wound is in the axilla, pressure must be made on the subclavian against the first rib and in the hollow behind the clavicle

FIG. 49. — Flexion of the Elbow to Arrest Bleeding Below.

FIG. 50. — Compression of the Subclavian Artery.

(Fig. 50); as a tourniquet cannot be applied here the fingers may be relieved by making the pressure with the handle of a large key, or the end of a pocket knife well wrapped.

In *bleeding from any part of the lower extremity* compress the

femoral against the head of the femur just below the middle of the groin, with both thumbs, as shown in Fig. 43, then apply a tourniquet to replace the thumbs.

If the *bleeding is from the foot* another method is to put a pad behind the knee and flexing the leg forcibly, tie the leg to the thigh as

FIG. 51. — Arrest of Bleeding by Flexion of the Knee.

shown in Fig. 51; if from the top of the foot a tourniquet may be placed over the anterior tibial in front of the ankle, or if from the sole of the foot over the posterior tibial behind the inner ankle.

FIG. 52. — Compression of the Carotid.

FIG. 53.— Compression of the Temporal Artery by Knotted Bandage.

Hemorrhage of the neck from the branches of the carotid is controlled by compression of the carotid with the thumb against the vertebræ (Fig. 52) a tourniquet cannot be applied here.

Bleeding from the tongue may be controlled in the same way, or by rinsing the mouth out with ice water, or holding pieces of ice in the mouth.

Bleeding from the lips may be very severe; it is controlled by grasping the lip between the thumb and fingers; as the arteries of the lip come from both sides, pressure must be made on both sides of the wound.

Bleeding from the face may be arrested by pressure on the facial in front of the angle of the jaw.

Bleeding from the scalp is easily arrested by pressure with a compress on the bleeding point, the pressure being made by a knotted bandage as shown in Fig. 53.

In *bleeding from the lungs* the blood is bright red, frothy, perhaps mixed with mucus, and is coughed up. Listen over the chest and where rattling is heard apply an ice bag; give the patient pieces of ice to swallow, and keep him perfectly quiet in the recumbent position; he should neither talk nor move.

In *bleeding from the stomach* the blood is vomited, is usually dark in color, and may be mixed with food. It is always well to remember that vomited blood does not necessarily indicate hemorrhage from the stomach; the blood may have been swallowed, coming from the back of the nose or throat; inquire whether there has been any nose-bleed. The treatment is the same as for hemorrhage from the lungs, except that the ice bag is applied over the stomach.

In *bleeding from the bowels* the blood is bright red if fresh; black and tarry if old. All that can be done is to apply cold applications to the abdomen and keep the patient quiet.

CHAPTER III

DISLOCATIONS AND SPRAINS

A *dislocation* is a permanent slipping away from each other of the bones which form a joint, with locking of the bones in the new position; the joint is out of place. Necessarily the dislocation is attended with tearing of the ligaments and often with rupture of the muscular attachments as well.

The cause is usually indirect violence especially falls and twists. In attempting to save one's self from falling the hand is thrown out and the weight of the body coming on it causes a dislocation of the shoulder; or the thigh in falling is bent backward, resulting in dislocation of the hip.

The symptoms of dislocation are as follows: The patient has fallen and cannot move the affected joint; there is pain of a sickening character, often with numbness or tingling in the limb below from pressure on the nerves and blood-vessels; on attempting to move the joint we find that it is locked and cannot be moved; on uncovering and examining it, it will be noticed that there is marked deformity in the joint, and that the limb is fixed in an unnatural position, and appears longer than the corresponding limb on the other side.

A dislocation must always be carefully distinguished from a fracture or a sprain. In fracture there is unnatural movement between the joints instead of immobility at the joint, and the movement is attended with a grating sensation and sound; the deformity is between the joints and there is usually shortening of the limb.

In sprains there is absence of any of the signs of dislocation except swelling and pain; the joint can be moved, though the patient will resist on account of the pain. Always uncover the limbs and compare the corresponding joints on the two sides.

If the services of a surgeon can soon be obtained nothing should be done for dislocations except to loosen the clothing about the injured part and support it as comfortably as possible in the new position. If the patient must be moved the limb should be supported in a sling, or by splints and bandages.

When, however, a physician can not be reached for some time, there are certain dislocations which a hospital-corps man may attempt to reduce. He must always remember that no force is to be employed, as it may do serious damage to the important vessels and nerves near the joint; the secret of success lies in the skillful manipulation with a clear understanding of the anatomy of the joint.

Fig. 54.—Subglenoid Dislocation of the Shoulder.

Dislocation of the shoulder occurs more frequently than dislocation of all the other joints in the body taken together; the reason of this has been explained on page 43; the most common dislocation of the shoulder is downward (Fig. 54). The symptoms are those described for dislocations in general; there will be a hollow under the point of the shoulder which will be very conspicuous when compared with the convexity on the other side and the head of the bone can be felt in the arm pit where it should not

Fig. 55.—Reduction of Dislocation of the Shoulder by the Foot in the Axilla.

be. To reduce this dislocation place the patient on his back on the ground; sit beside him; remove one shoe from your foot and place that foot in the patient's axilla; then using the foot as a fulcrum, draw the arm downward in the direction of its axis, then outward, and finally carry it across the chest (Fig. 55); or *Kocher's method*

may be tried as follows: Flex the forearm to a right angle, bring the elbow to the side; carry the hand and forearm outward; then lift up the elbow and sweep the forearm across the front of the chest. If successful the humerus will suddenly slip into place with a click; the arm should then be bandaged to the side for a week or two to give the torm ligaments a chance to heal. If unsuccessful after a few minutes' trial further attempt should be postponed. A shoulder once dislocated is usually permanently weak, and the dislocation is apt to recur from slighter violence than at first.

In *dislocation of the lower jaw* (Fig. 56) the patient can not speak or close the jaws, and is in great distress.

This dislocation is usually reduced without much difficulty, but there is great danger of the thumbs of the operator being bitten. Wrap the thumbs well with a handkerchief or bandage; stand in front of the patient, and while pressing with the thumbs in the mouth just back of the last lower molars at the same time with the fingers lift up the chin; the jaw will usually at once snap into place, and the thumbs must be quickly withdrawn to prevent them being bitten. After reduction bind the lower jaw to the upper with a four-tail bandage.

FIG. 56.— Dislocation of the Lower Jaw.

In *dislocation of the finger joints* pull on the dislocated end, at the same time bending it backward if the dislocation is forward, or forward if the dislocation is backward, and pushing the joint into place. After reduction strap or splint the finger.

The *patella* or *knee-cap* may be dislocated outward or inward; there is sickening pain, the knee cannot be moved, and on examination there is a hollow in front of the knee where there should be fullness, and the patella can be seen and felt in its new position.

Extend the knee as much as possible and flex the thigh so as to relax the muscles, when the patella can usually be pushed into place.

In *sprains* the joint surfaces slip apart, tearing the ligaments, but slip back into place again; a sprain is really a momentary dislocation. The tearing of the ligaments causes hemorrhage into and around the

joint, and as the blood can not escape externally the joint is immediately swollen; that the swelling is due to the bleeding is shown by the black and blue discoloration of the skin over the joint which begins to appear after a day or two as the blood comes to the surface.

The treatment consists in stopping the hemorrhage, causing the absorption of the blood already poured out, and supporting the joint until the ligaments heal.

A *sprained ankle*, the most common of all sprains, may be taken as a type. The patient twists his foot stepping on a stone, there is sharp pain in the ankle, lameness, and prompt swelling of the joint, but the joint is movable, thus excluding dislocation, and there is an absence of the signs of fracture.

FIG. 57.— Strapping the Ankle.

To control the bleeding put the foot at once into a pail of hot water, as hot as can be borne, and keep it there ten minutes; or if there is no water hot enough use ice water. Next shave, dry and powder the foot and then strap the joint firmly with rubber adhesive plaster, using strips about an inch wide and fifteen to eighteen inches long (Fig. 57). The first strap should form a stirrup of the heel, closely following the tendo Achillis on each side; the second should cross the first at a right angle, extending along the border of the foot from the root of the little toe to the root of the great toe or *vice versa;* the third strap covers one-third of the first and the fourth one-third of the second and so on until the entire ankle is covered except a narrow strip in front which is left open to allow of free circulation. Each strap is drawn tight and the crossings are made strongest over the swelling. When the strapping is completed a bandage is applied over all until the plaster is firmly adherent, when

the bandage is removed, the sock and shoe put on and the latter firmly laced, after which the patient should begin to walk, commencing with a crutch or cane.

The walking is at first very painful, but must be persisted in, as the plaster takes the place of the torn ligaments and the movement of the joint in walking causes rapid absorption of the blood. As the strapping becomes loose it must be reapplied after thorough massage of the joint.

CHAPTER IV

FRACTURES

A *fracture* is a *broken bone.* There are two great classes of fractures, simple or closed and compound or open.

A *compound* or *open fracture* is one in which there is a wound communicating with the broken ends of the bone; the broken bones are open to infection. A *simple* or *closed fracture* is one in which the broken bones are closed to the air and to infection in that there is no wound communicating with the fracture.

Fig. 58.— Green-stick Fracture.

A fracture is *comminuted* when the bone is broken into more than two pieces; *complicated* when there are also injuries to the adjoining vessels, nerves, or muscles; *impacted* when the broken ends are driven into each other so that they can not move; *green stick* when the bone is bent and only partially broken as a green stick is broken (Fig. 58).

Fractures are caused by *direct violence,* as when a wagon wheel passes over a limb and breaks it; *indirect violence,* as when a man falls on his hand and breaks his collar bone; *muscular action,* as when one breaks his arm throwing a ball.

How will you know that a fracture has occured? First there is a loss of power in the part; if the leg is broken the man has fallen and can not get up; if it is the arm he can not use it. Then the limb is in an unnatural position; if you compare it with the uninjured limb you will see that there is a deformity between the joints, and that the injured limb is probably shorter. If you attempt to move the limb you find there is *movement*

Fig. 59.— Union of a Fracture.

between the joints where there should be none, and you can both feel and hear the broken ends of the bone grating together — *crepitus.*

The patient complains of great pain and tenderness at the seat of fracture and there is swelling there due to bleeding from the broken ends. There is a history of violence and often the patient will say that he heard the bone crack and give way.

In the treatment of fractures the great point is to keep them from becoming open; a closed fracture is a very simple matter, not dangerous to life, and usually healing promptly if kept quiet in proper position; an open fracture is quite another matter, always taking a long time to heal and often threatening loss of limb and even life from infection.

FIG. 60.— Use of Wire Gauze as a Splint.

Therefore never attempt to move a man with a fracture until the fracture has been fixed so that the broken ends of the bone can not move. If a physician can be obtained at once merely make the patient comfortable with pillows and supports where he lies; if he must be moved apply splints, handling the broken bones very carefully so that sharp ends may not come through the skin and make the fracture compound. If a physician can not be reached for a day or two set the fracture and then splint it.

The cause of deformity in fractures is muscular contraction, and this contraction must be overcome in *setting* the fracture, which is merely getting the broken ends into proper position; this is done by *extension* and *counter-extension;* extension is pulling the far end of the limb, and counter-extension is merely holding the end next the trunk; pull until the deformity and shortening disappear and the

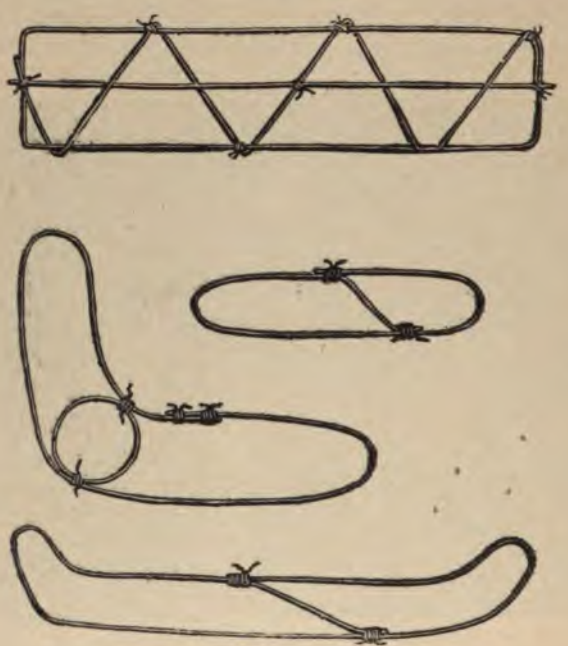

FIG. 61.— Splints of Telegraph Wire.

two limbs look alike, then hold them so while the splints are applied.

When a fracture is properly set the blood which escaped into the tissues about the break is gradually absorbed and at the end of a week or ten days *callus* is thrown out or the limb begins to *knit;* callus is a soft, cement-like substance which is poured out between the broken ends around them, and in the medullary cavity; the callus gradually hardens into bone. That which is around the break forming a sort of ferrule or splice, and that in the medulla forming a pin, are absorbed after many months; but that between the bones remains

permanently, knitting the bone together (Fig. 59). Sometimes the callus is not sufficient in quanity or quality and union fails to take place.

When a fracture is already open or compound the object of treatment is to convert it into a simple fracture, or at least to prevent infection. The wound is first dressed and then the fracture is treated.

A *splint* is merely a splice to hold the bones in proper position until nature unites them. Splints must be light but sufficiently rigid to prevent bending; long enough to fix the joints above and below the fracture; broad enough to prevent pinching of the limb in bandaging; sufficiently padded to protect the part from undue pressure.

FIG. 62.

FIG. 63.

There are many splint materials supplied, among the more common being thin boards, cardboard, felt, leather, wire gauze (Fig. 60), etc. Often in the military service splints must be extemporized; one of the most useful and most accessible materials for preparing them is telegraph wire; the method of using it is illustrated in the figures (Fig. 61). On the battlefield the various weapons may be employed: rifles, bayonets, swords, scabbards (Fig. 62), and tent pins; splints may also be prepared from blankets and straw, from hay, small

sticks, the bark of trees, barrel staves, broom handles, canes and umbrellas.

Padding may be made of clothing, hay, straw, grass, leaves, excelsior, cotton, crumpled paper, etc.

The best things to hold splints in place are straps which can be readily buckled and unbuckled; the next best is the loop bandage applied as shown in Fig. 64; roller bandages, triangular bandages, tape, and many other things may be used. Before the splints are applied permanently the limb is usually bandaged from the extremity up to the fracture in order to prevent swelling below; after the ap-

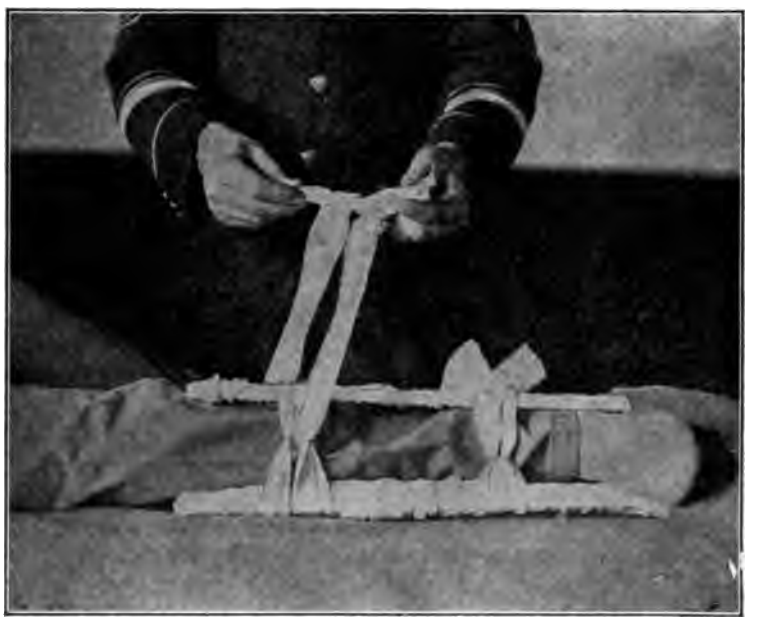

FIG. 64.— Loop Bandage to Retain Splints.

plication of the splints another bandage is applied over all. Be careful not to make the dressing too tight, and always leave the tips of the fingers exposed so that the circulation may be watched. If the tips of the fingers are blue and cold, or if upon pressing the blood out from under the nails it does not quickly return the dressing is too tight.

After splinting the upper limb it must be placed in a sling; if there are no materials available to form one, the coat sleeve may be

simply pinned to the coat, or the flap of the blouse may be turned up and pinned, ripping the seam if necessary (Figs. 65 and 66).

Fractures of the *skull* and *spinal column* are chiefly of importance on account of the coincident injury to the important parts of the nervous system which lie immediately beneath the bone. In fractures of the skull, unless compound or depressed, all the usual symptoms of fracture are absent, or entirely overshadowed by the injury to the

FIG. 65.

FIG. 66.

brain. The most prominent brain symptoms are loss of consciousness and paralysis; if the loss of consciousness is sudden it is probably due to the pressure of a piece of bone; if it comes on slowly it is apt to be the result of hemorrhage from a torn vessel. *In fractures of the base of the skull* there may be bleeding from the nose or ears, or into the orbits and under the conjunctiva; the escape of

cerebro-spinal fluid — a clear, watery serum — from the ears is considered a sure sign of fracture of the base

Treatment: Keep the patient quiet in a recumbent position and apply an ice bag to the head; if the fracture is compound a dressing will be required.

In fractures of the *spinal column* the spinal cord is generally injured or cut across, with resulting paralysis of all parts below the fracture. On examination, irregularity of the spinous processes will be noted, usually with angular deformity. Handle the patient with great care so as not to produce or increase injury to the spinal cord. Before moving him apply splints on both sides, from his armpits to his feet, so as to make the body as rigid as possible, then work a blanket under him, and, drawing it as tight as possible, lift him on a litter.

Fig. 67.— Four-tail Bandage for Fracture of Jaw.

Fractures of the ribs and pelvis are also chiefly important on account of the injury to the contained viscera.

In *fracture of the ribs* the sharp end of the bone is apt to stick into the lung every time the patient breathes; hence in these cases the patient will often complain of a sharp sticking pain when he breathes, and there may be cough, with spitting of frothy blood. When the fingers are passed firmly along the ribs they may be felt to give at the broken point, which is also very tender.

The treatment consists in confining the movements of that side of the chest as much as possible, in order to give the broken bone an opportunity to rest and *knit*. This is done by circular bandaging of the whole chest or by strapping one side.

Fig. 68.

The *pelvis* is so strong that the bones are broken only by the most severe direct violence, as when a heavy wagon passes over it. The symptoms are inability to stand or sit up, and crepitus may be felt when firm pressure is made. If there is an injury to the bladder the

urine contains blood. The treatment consists in the application of splints on both sides from the axillæ to the feet; if the bladder is injured a catheter must be introduced and left in, so that the urine will not accumulate and escape into the peritoneal cavity.

In *fracture of the nasal bones* there is usually considerable deformity, the bridge of the nose being caved in and pushed to one side; crepitus is generally to be felt, and there is considerable nose-bleed.

Check the bleeding by syringing with hot or cold water; push the bones into place by means of a probe or slender, smooth stick in the nostril, aided by the fingers outside. Apply cold dressings over the bridge of the nose and warn the patient not to attempt to blow the nose.

Fig. 69.

In *fracture of the lower jaw* the line of teeth is irregular and there may be bleeding from the mouth; the patient can not open his mouth, and the fracture can usually be readily felt.

Push the bones into place and apply a four-tailed bandage (Fig. 67) or two narrow cravats. The patient can not chew and will have to live for a time on liquid foods taken through a tube.

In *fracture of the clavicle* the attitude of the patient is often characteristic; the shoulder drops downward, inward and forward, and he attempts to support it by holding the elbow of the injured side in the hand of the sound side. The collar bone lying immediately under the skin, the fracture is easily made out.

As a first-aid dressing, put the arm in a large sling, place a pad in the axilla, and bind the arm to the side. The fracture is put up permanently in a *Sayre's dressing* or a *Velpeau bandage*.

Fig. 70.— Colles' Fracture.

Fracture of the humerus or arm bone has all the common signs of fracture and may ordinarily be recognized without difficulty. Two splints are required; they should be placed on the inner and outer sides, except in fracture near the lower end of the bone, when the splints should be front and rear (Fig. 68).

If the fracture is near the shoulder joint a shoulder cap must also be used, and if near the elbow joint the inner splint should be rectangular and include the forearm. The wrist should be supported in a sling, leaving the elbow hanging down so as to produce extension. If no splints are available the arm should be at least bandaged to the side of placed in a sling.

When *both bones of the forearm are broken* all the usual signs of fracture are present. Place a splint on each side, from the elbow to the root of the fingers, and put the arm in a sling (Fig. 69).

As a general rule, in all fractures of the upper extremity flex the elbow to a right angle, and place the forearm in such a position that the thumb will point up.

The reason of this is, that should the elbow become stiff, the arm is more useful in that position than any other; the thumb should point up, that is, the forearm be midway between pronation and supination, for in that position there is the widest possible space between the radius and ulna, and therefore they are less apt to become fused together by the callus which is thrown out in the process of union.

Fracture of the radius alone, just above the wrist, is very common and is known as *Colles' fracture*. It is attended by a peculiar silver-

Fig. 71.

fork deformity (Fig. 70), and as the bones are usually impacted, crepitus is absent. The setting of this fracture can only be properly done by a surgeon; meantime the arm should be placed in a sling.

Fracture of the metacarpals — a broken hand — usually occurs in a fight. The most prominent signs are deformity and pain. Splints should be applied on the back and front of the hand, reaching from the finger tips half-way up the forearm.

Fractures of the fingers are treated by the application of narrow finger splints, usually on the palmar surface only.

In *fractures of the femur* all the common symptoms of fractures

are usually present; the foot may be everted, lying on its outer side, and the leg is shorter than the other. Two splints must be applied; the one on the outside reaches from the armpit to beyond the foot; the one on the inside from the crotch to the foot (Fig. 71). The splints should be tied on in five places: around the ankles, over the knees, just below the hips, around the pelvis, and just below the axilla. It is well also to tie the two limbs together.

FIG. 72.— Dressing for Broken Knee-Cap.

So powerful are the muscles of the thigh, constantly tending to make the bones overlap, that in the permanent treatment in hospitals it is customary to provide special arrangements for overcoming the muscular action.

These arrangements comprise what is called *extension*. A weight is attached to the foot by adhesive-plaster straps, and a cord running over a pulley, and counter-extension is provided by raising the foot of the bed, thus utilizing the weight of the body.

Fractures of the lower extremity are always put up with the entire

FIG. 73.

limb straight, so that if the joints get stiff the limb can be at least utilized for standing and walking.

In *fractures of the patella or knee-cap* the patient can not stand or walk; the upper fragment is drawn up the thigh by the powerful muscles attached to it, and the gap can be readily felt. The joint swells up at once. A splint should be applied to the back of the knee

so as to keep the limb extended, and the upper fragment should be brought down by figure-of-eight bandaging (Fig. 72).

If *both bones of the leg are broken* the fracture is very apt to be compound because fracture of the tibia is usually oblique with a sharp point that may come through the skin; such a fracture should be handled with the greatest care. Apply splints from the knee to beyond the foot on the inside, outside, and behind (Fig. 73). Tie the feet together.

Fracture of the fibula alone just above the ankle is called *Pott's fracture,* the signs are usually indistinct, but if the lower end of the tibia is fractured as well there is apt to be marked eversion of the foot.

Treat in the same manner as a fracture of both bones, except that the posterior splint is not necessary.

Fractures of the bones of the foot are best treated by a plaster-of-Paris dressing.

CHAPTER V

FOREIGN BODIES

In the eye: Foreign bodies such as particles of dust, cinders, etc., may lodge under the lids, upon the conjunctiva, or upon the cornea. In the latter situation they are seen and removed with the greatest difficulty, and the removal should not ordinarily be attempted by other than a physician. To remove a foreign body from the eye the best improvised appliance and one that is nearly always at hand is a match. Light the match and after it has burned a moment blow it out; then with a clean handkerchief and a circular movement of the fingers wipe off the charred end, leaving a soft, aseptic, splinterless point with which to remove the foreign body.

FIG. 74.— Eversion of the Upper Eyelid.

To examine the lower lid draw it down with the fingers, at the same time telling the patient to look up; if the foreign body is not found there, evert the upper lid (Fig. 74) by standing behind the patient with his head upon your chest and telling him to look down at his feet; at the same time press a match or the end of the finger firmly against the outside of the lid about a quarter of an inch behind its margin, draw the lid down by the lashes and turn it upward and outward over the match or finger tip. If the particle is still not visible search the ball of the eye carefully for it, and when it is found lift it off gently by a quick movement with the point of the match. If the eye is very irritable it may be necessary to drop in a little cocaine solution.

It is important to remember that even after a foreign body is re-

moved from the eye, there is often for some time a sensation as if it were still there.

In the ear: The foreign body here may be an insect, a pea, or grain of wheat, a pebble, a plug of hardened wax, etc. An insect in the ear by its movements and buzzing often causes the most intense annoyance.

Hold the head over on one side with the ear containing the insect uppermost; fill the ear with warm water; this will drown the insect in a few minutes, and then by suddenly turning the head to the other side it may come out with the water; the maneuver should be repeated several times; if the insect does not come away syringe the ear.

If the foreign body is vegetable, such as a pea, water should not be used as it may cause the pea to swell and thereby render its extraction more difficut. If the pea is visible bend the loop end of a fine hairpin, and try to get beyond it so as to hook it out. As there is always danger of injuring the drum when instruments are pressed into the ear, it should be a guiding rule that no instrument should be passed beyond the point where its tip can be seen.

Hardened wax must be removed by syringing with a warm five-per cent solution of soda.

In the nose: Children push peas and such things into the nose, and occasionally flies deposit their eggs there with the result that maggots develop in the nasal cavity. Foreign bodies are best removed by closing the free nostril with the finger and forcibly blowing through the obstructed side; snuffing up a little powdered tobacco or pepper will cause sneezing and aid in the expulsion; if this does not succeed and the body can be seen it may be hooked out with the bent hairpin in the same manner as described for the ear; or finally a small, smooth stick or a slender pencil may be wrapped with a little cotton and used to push the foreign body gently back through the posterior nares into the mouth; press straight backward, never upward.

Maggots in the nose is a very serious condition which may result in death. Let the patient inhale through the nose a half-teaspoonful of chloroform, and while the maggots are stupefied syringe them out with warm normal saline solution.

Foreign bodies in the throat are usually bones or masses of food. If the bone can be seen and reached it may be removed by fingers or forceps; if not it may be carried down by eating dry bread. If the

obstruction is a mass of food it may be dislodged by forcible blows on the back between the shoulders, or the fingers may be passed into the throat to hook it out or to cause its ejection by vomiting.

Foreign bodies in the air passages cause violent cough and difficult breathing; the case is urgent, and if a child he may be held up by his heels and shaken; if an adult inversion may also be attempted and blows between the shoulders given as in the case of foreign body in the throat.

Foreign bodies are sometimes swallowed and reach the ***stomach*** and ***intestines.*** Such cases are not usually serious. If the body is angular or pointed such as a tack or a pin, feed the patient on substances which leave considerable residue to cover and protect the sharp points; — potatoes, bananas, bread, etc. Do ***not*** give laxatives as they will render the movements liquid and thus leave sharp points exposed.

In the skin: Here we find ***splinters, thorns, needles, pins, fish-hooks, pieces of glass, gunpowder, etc.*** For splinters and thorns pass the point of the blade of a pocket-knife under them, with the thumb-nail press the splinter against the blade and draw it out; or use a pointed dissecting or dressing forceps. If the splinter is buried open up the skin a little with the point of a knife or a needle until it can be reached. If under a nail make a notch in the nail so as to expose it.

If a needle or pin is broken off in the skin and can not be grasped with forceps, cut a small hole in the end of a cork and press it down over the point of entrance of the needle; this may cause the needle to emerge so far that it can be grasped. The needle may be so situated that it is best to push it through and extract it on the other side. If the needle or pin is in the foot or hand and can not be extracted, the patient should be directed not to use the part, as muscular action will cause it to work in deeper. A fishhook or an arrow can not be drawn out on account of the barbs; they must be pushed through. Gunpowder is best removed by a thorough scrubbing with soft soap and a stiff brush, the remaining grains being picked out with a needle.

CHAPTER VI

THE EFFECTS OF HEAT AND THE EFFECTS OF COLD

THE *effects of heat* may be general or local. The *general effects of heat* are manifested in two entirely different ways, viz.: heat stroke and heat exhaustion.

Heat stroke, sunstroke, or insolation is due to prolonged exposure to excessive heat, usually the heat of the sun. But heat stroke may occur in hot rooms, and in the stoking-rooms of steamships. Exhaustion and improper clothing are powerful contributing factors, hence it is especially apt to occur to soldiers on the march.

The premonitory symptoms are headache, dizziness, irritability, frequent desire to urinate, seeing things red or purplish; with or without these symptoms the patient suddenly falls unconscious; the skin is dry and intensely hot; pupils contracted; pulse full and strong; respirations snoring; there may be convulsions; if the temperature of the body can be taken it will usually be found to be very high, 105° F. to 109° F. or higher.

The condition is a very serious one and unless immediately relieved terminates in death.

The treatment has for its object rapid reduction of the temperature. The man should be brought to the coolest accessible spot, in the shade if out of doors, on deck if in the fire room of a steamer, his clothing removed and an ice bag applied to his head and cold water poured over him continually. At the same time the body may be rubbed with ice, and if a tub is available he may be immersed in cold water. The treatment should continue until the temperature is reduced. If the patient is able to swallow he should be given cold, not iced, water to drink, and this should be repeated as often as possible.

Serious results are liable to follow a sunstroke, even when death does not occur; the most common of these after-effects are permanent headache, paralysis, mental confusion, or even insanity. Moreover, one who has had a sunstroke is ever after very susceptible to the action of the sun.

Heat exhaustion is a very much less severe condition, closely allied to fainting. It occurs among soldiers on the march and very frequently among soldiers standing for some time at *attention* on a hot day. The soldier suddenly drops his piece and falls; he is not unconscious or may be easily aroused; face is pale, skin cool and moist, pupils dilated or normal, pulse very weak; respiration shallow, perhaps sighing.

Such a patient should be moved into the shade, his clothing loosened, equipments removed, head kept low, and a drink of water or some stimulant given. On removal to the hospital he should be kept perfectly quiet in bed and hot-water bags used if necessary.

The *local application of heat* produces burns or scalds.

Burns are produced by a flame, hot solids, or caustics. *Scalds* are produced by hot liquids; they differ only in that in the former the hairs are destroyed, in the latter they are not; the treatment is the same.

Burns are usually said to be of the first, second, or third degree. Burns which merely cause redness are of the *first degree;* if blisters are raised they are of the *second degree;* and if there are charring and destruction of tissue the burn is of the *third degree.*

The symptoms of burn are shock which may be profound, chilly sensations, and pain. The pain may be agonizing or slight.

The result of the burn depends more upon the extent of surface affected than upon its depth, a burn of the first degree is almost certainly fatal if two-thirds of the surface of the body is affected, and one of the second degree if one-third of the body is burned; the chances for recovery are much less in children and elderly people.

The danger in the first twenty-four hours is from shock; after that from internal congestions and inflammations, suppression of urine, ulceration of the duodenum, and intestinal hemorrhage; and finally from exhaustion, blood poisoning, or tetanus.

If the entire thickness of the skin is destroyed terrible deformities are apt to follow the contraction of the skin which occurs in healing.

In burns of the first degree, of which *sunburn* is a type, soft cloths dipped in a saturated solution of cooking soda should be applied, and this followed by any fresh oil or fat; cream or olive oil answers excellently well.

In burns of the second and third degrees the objects of treatment are first protection from the air which greatly aggravates the pain

[illegible], secondly relief of shock, and third prevention of infec-[illegible]

[illegible] quickest temporary means of excluding air is to immerse the [illegible] entire body in warm water; then having gotten everything ready carefully cut away the clothing, leaving such as is sticking to the burned skin; blisters should be left undisturbed unless they are very tense and painful, when they may be punctured by a [illegible] needle and the contents allowed to escape.

The wound should next be dressed with sterile gauze dipped in a warm solution of boric acid, or a solution of picric acid ten parts in [illegible] parts of alcohol and a thousand parts of water; the picric acid [illegible] the pain and has value as an antiseptic; over the gauze place [illegible] layer of sterile absorbent cotton. When the burns are ex-[illegible] small portions only should be exposed and dressed at a time. When the first dressing is finished it should be left on as long as possible.

Meanwhile stimulants and hot drinks should be given internally and morphine and strychnine injected hypodermically if necessary.

When there has been skin destruction the parts should be retained in proper position by splints when healing is taking place.

In *burns from corrosive acids*, such as sulphuric and nitric acids, the parts should be thoroughly flushed with water and a solution of soda, after which the treatment is the same as for other burns.

In *burns from caustic alkalies*, such as lye, vinegar diluted with water should be used to neutralize the alkali before applying the usual treatment for ordinary burns.

When the clothing of a person, usually a woman, is on fire she should be enveloped in a blanket, rug, cape, or woolen coat and thrown upon the ground while the flames are smothered; the reason she should be thrown upon the ground is to prevent her from running about and thus fanning the flames, and also because flames rise, and in the erect position would reach the mouth and throat.

The effects of excessive heat may be general or local.

In general [illegible] at first a very unpleasant sensation of cold with [illegible] then numbness and stiffness, and finally [illegible] and sleep. [illegible]

When [illegible] being exposed he should be [illegible]

body rubbed briskly with sheets or towels wet with cold water. As soon as the stiffness is removed artificial respiration should be performed; and when the patient is able to swallow, warm drinks should be given. When there are signs of returning consciousness and circulation the body may be enveloped in a blanket and the temperature of the room gradually raised.

The reason a frozen person must not be brought into a warm room is that the sudden restoration of the circulation gives rise to violent congestions and ofter to sudden death from the formation of clots in the blood-vessels.

Local freezing is of two degrees, frost-bite and chilblain.

Frost-bite is usually of the extremities, fingers, toes, nose, or ears, but a whole limb may be frozen. The part is at first red and painful, then livid, and finally white, hard, and painless; the sudden cessation of pain in the freezing part is always a bad sign. The danger of frost-bite is that sudden thawing may cause such severe congestion as to result in gangrene.

Therefore the patient should not go into a warm room or near a fire. Rub the part vigorously with wet snow or ice water, never with dry snow as the temperature of dry snow may be much below freezing, and rubbing with it would aggravate the condition. When the pain and redness return apply cold dressings.

Chilblain is a condition of acute or chronic congestion occurring especially in the feet, and due to bringing cold feet near the fire too suddenly, or merely following exposure to cold in persons with poor circulation. On the part affected are red spots, more or less swollen, which burn and itch intensely. The treatment consists in stimulating applications, such as liniments and tincture of iodine. Susceptible persons should wear woolen socks.

CHAPTER VII

INSENSIBILITY AND FITS

AMONG *conditions causing insensibility* are fainting, shock, concussion and compression of the brain, apoplexy, lightning stroke, electric shock, heat stroke, freezing, epilepsy, Bright's disease, alcoholism, narcotic poisoning, and asphyxia or suffocation.

Fainting is a condition due to too little blood in the brain, and is caused by mental impressions, exhaustion, heat, bleeding, overcrowded rooms, etc. The symptoms are sudden unconsciousness, pale face, cool, moist skin, weak pulse, shallow breathing, and dilated pupils.

Treatment: Get more blood to the brain by laying the patient flat on his back with the head low and the legs raised; sprinkle cold water in his face and apply ammonia or smelling salts to the nostrils to make him breathe, get him out of a crowd into the fresh air, loosen the clothing about his neck and waist.

If he is sitting in a chair and about to faint the attack can often be prevented by thrusting the head down between his own knees and holding it there until the face becomes flushed.

Shock is a condition similar to fainting but due to physical injury. It has been fully dealt with on page 90.

Concussion of the brain is the condition present when we say a man has been "knocked senseless" or "stunned." It is a jarring and shaking of the brain due to blows or falls upon the head or falls upon the feet; the brain almost stops working for a while. The symptoms are unconsciousness, pallor of the face, breathing so quiet and shallow that it can hardly be detected, pulse fluttering, pupils equal and usually contracted.

The degree of insensibility varies; sometimes the patient can be aroused but is irritable and lapses again into unconsciousness which may last minutes or hours. Vomiting and turning on the side are favorable symptoms.

Treatment: Perfect rest in a dark, quiet room; warmth externally

if the surface is cold; aromatic spirits of ammonia internally or by inhalation if there is much depression.

Compression of the brain is as its name implies a pressure on the brain. This pressure is due usually to either a piece of bone or to blood from a torn vessel which has escaped inside the cranuim and as it can not get out must compress the brain, and this compression prevents certain parts of the brain from working. When the bleeding is the result of injury the condition is called simply compression of the brain; when it is the result of the bursting of a diseased vessel without any violence it is called *apoplexy;* the result and the symptoms are just the same.

The symptoms of compression are profound unconsciousness; loud, snoring breathing; slow pulse; pupils usually unequal and not reacting to light, and paralysis on one side of the body.

If the compression is due to a piece of broken bone the symptoms come on immediately after the injury, while if it is due to bleeding they may come on later and gradually.

Treatment: If the compression is due to a piece of depressed bone the bone must be raised. If due to bleeding, the bleeding must be stopped; surgical relief can only be given by a surgeon, but meantime keep the patient quiet with his head slightly raised; apply an ice bag to the head, give him a hot mustard foot bath, and put a few drops of croton oil in a teaspoonful of sweet oil on his tongue, so as to send the blood from his brain to the feet and intestinal tract.

Lightning stroke may cause sudden death, insensibility, or severe burns. If the patient is unconscious but living, effort should be made to keep him alive; perform artificial respiration if the breathing fails; give stimulants if the heart is weak, and apply heat externally if the surface is cold. Burns must be treated like other burns.

Electric shock is caused by coming in contact with a "live wire"; spasmodic contraction of the muscles occurs so that the person can not let go. The condition and results are exactly like lightning stroke.

The first thing to be done is to rescue the patient by setting him free from the wire, and this must be done with great care, as to touch him with the bare hands will cause the rescuer to get the same shock.

Immediately break the circuit. With a single quick motion, free the victim from the current. Use any *dry* nonconductor (clothing, rope, board) to move either the victim or the wire. Beware of using

metal or any moist material. While freeing the victim from the live conductor have every effort also made to shut off the current quickly.

The treatment of the shock is the same as in the case of lightning shock.

The forms of unconsciousness due to heat stroke and to freezing have already been described.

Unconsciousness from acute alcoholism is the condition known as "*dead drunk.*" The patient is insensible, though he can usually be partially aroused, the face is flushed and bloated, eyes bloodshot, pupils usually dilated, skin cold and clammy, temperature subnormal, respiration snoring, pulse rapid and weak; there is no paralysis.

Treatment: The case is one of acute poisoning by alcohol. The first thing to be done is to empty the stomach, by tickling the throat or by giving an emetic of mustard or salt and warm water. Then sprinkle cold water freely upon the face, but apply heat to the body; a cup of hot coffee may help to clear the brain after the stomach is emptied. Usually an undisturbed sleep is necessary.

It must not be forgotten that alcoholism and apoplexy are frequently confounded, the more so as a man who has been drinking and has the odor of liquor upon his breath may be stricken with apoplexy.

In apoplexy there are paralysis, unequal or contracted pupils, some fever, slow pulse; in alcoholism no paralysis, equally dilated pupils, rapid pulse, subnormal temperature.

In *epilepsy* there may be *fits* with insensibility, or a mere momentary unconsciousness with slight muscular twitching, but in which the patient does not fall.

In the severe form, with or without some premonitory sign, the subject suddenly cries out in a peculiar manner and falls in a fit; at first the entire body is rigid, then there are general convulsions with jerking of the limbs, contortions of the face, and foaming at the mouth; after a few minutes the convulsions are followed by profound stupor, and this generally passes off in deep sleep. During the attack the eyeballs may be touched without the patient flinching, the pupils are dilated, he often bites his tongue, and there may be involuntary evacuations of the bowels and bladder.

Epileptic stupor may be distinguished from other forms of unconsciousness by the history of the fit, and of other fits, by the foam

at the mouth and the bitten tongue, and by the absence of any paralysis.

Treatment: You can do nothing to stop the fit or to control it; all that can be accomplished is to prevent the patient from hurting himself and to make him as comfortable as possible; do not attempt to hold him, but twist a handkerchief and passing it between the jaws tie it at the back of the neck to keep him from biting his tongue until after the fit is over; after which let him sleep as long as he wishes.

Epileptic fits are frequently feigned by soldiers in order to secure their discharges. The feigned attacks usually occur at night when no one can see them; the man does not fall so as to hurt himself, does not bite his tongue, flinches when the eyeball is touched; the pupils are not dilated; the patient can be aroused; when there is foaming at the mouth a piece of soap will often be found inside.

A pail of cold water suddenly thrown upon the man's head and shoulders usually makes the diagnosis; it promptly revives the malingerer, but has little or no effect upon the epileptic.

The insensibility of Bright's disease is really an acute poisoning from the retention of the waste products which the diseased kidneys are not able to carry off. The unconsciousness is often attended with delirium and convulsions. The pupils are contracted, the pulse slow, and the breathing loud and snoring.

The distinguishing characteristics are the history of Bright's disease, the waxy color of the skin, sometimes dropsy, the equally contracted pupils, the absence of paralysis.

Emergency treatment: Cold cloths to the head and a hot mustard poultice to the back over the kidneys.

In *opium poisoning* the patient may be very sleepy or deeply unconscious, the pupils are minutely contracted, the respiration very slow, as low as eight or ten to the minute, and snoring, and the pulse rapid and weak. If the opium has been swallowed, empty the stomach by an emetic, and then give a half gramme of permanganate of potash dissolved in half a pint of water to destroy what opium is left.

Next keep the patient awake by giving him strong, black coffee, pinching him, talking to him, and walking him up and down if possible, but not to the point of exhaustion.

Asphyxia or suffocation is another cause of unconsciousness, to which it is necessary to devote a special chapter.

CHAPTER V

ASPHYXIA

Asphyxia or *suffocation* is that form of unconsciousness due to the cutting off of the supply of oxygen to the lungs. This may occur in several ways. The air may be so full of some other gas that the proper amount of oxygen cannot reach the lungs; this is what happens in cases of poisoning from illuminating gas, the gases in mines, etc.

When a person is buried up to his neck in a slide of earth or snow he may be asphyxiated as a result of the inability to expand his chest, even though the mouth and nose be free. The air may be cut off at the mouth as when one is smothered by a pillow; in the throat by the lodgment of food in the larynx, or its obstruction with the membrane of diphtheria. The supply of air may be shut off by the pressure of a rope or fingers when one is hanged or strangled. In drowning, water gets into the air passages and mechanically shuts off the air. Finally when anesthetics, such as ether or chloroform, are given, asphyxia may result from an insufficient admixture of air.

The treatment of asphyxia consists first in removing the cause, second in restoring the breathing by artificial respiration. If the patient is overcome by gas remove him to the fresh air, if he is taking an anesthetic stop it, if he is buried in a snow-slide dig him out as quickly as possible, if there is a piece of meat in the throat put your finger in and hook it out or beat him between the shoulders and jar it out. If the larynx is obstructed by membrane it may be necessary to make an opening into the trachea (tracheotomy) and put in a tube; if the patient is hanging cut him down; if he has been drowned get the water out of his air passages; do these things first, then perform the artificial respiration.

Artificial respiration seeks to imitate the natural breathing. There are several methods, the following recommended by the "Committee on Resuscitation from Electric Shock," is probably the best, as it can be done with the least difficulty by one man.

Proceeds as follows: (a) Lay the subject on his belly, with

arms extended as straightforward as possible and with face to one side, so that nose and mouth are free for breathing. Let an assistant draw forward the subject's tongue

FIG. 75.—Artificial Respiration. Inspiration; Pressure Off.

(b) Kneel straddling the subject's thighs and facing his head; rest the palms of your hands on the loins (on the muscles of the

FIG. 76.—Artificial Respiration. Expiration; Pressure On.

small of the back), with fingers spread over the lowest ribs, as in Fig. 75.

(c) With arms held straight, swing forward slowly so that the weight of your body is gradually, but *not violently*, brought to bear

upon the subject (see Fig. 76). This act should take from two to three seconds.

Immediately swing backward so as to remove the pressure, thus returning to the position shown in Fig. 75.

(d) Repeat deliberately twelve to fifteen times a minute the swinging forward and back — a complete respiration in four or five seconds.

FIG. 77.— Artificial Respiration. Marshall Hall's method. Expiration.

(e) As soon as this artificial respiration has been started, and while it is being continued, an assistant should loosen any tight clothing about the subject's neck, chest or waist.

Continue the artificial respiration (if necessary, at least an hour), *without interruption*, until natural breathing is restored, or until a physician arrives. If natural breathing stops after being restored, use artificial respiration again.

Do not give any liquid by mouth until the subject is fully conscious.

Give the subject fresh air, but keep him warm.

Pause for a moment occasionally to see whether the patient makes any effort to breathe; if he does, time your movements so as to cor-

respond to the natural inspiratory and expiratory efforts. Usually the first signs of success are a change in the color of the face and faint sighing.

Meanwhile efforts should be made to excite respiration in other ways; apply snuff, tobacco, pepper, or smelling salts to the nostrils, and strike the chest with towels dipped in hot and cold water alternately.

Marshall Hall's method: In this method the patient is placed on the floor or ground with the face downward, his forehead resting on

FIG. 78.— Artificial Respiration. Marshall Hall's method. Inspiration.

one arm, and a roll of clothing supporting his chest. While in this position the weight of the body compresses the ribs and expels the air from the chest — an artificial expiration which is deepening by making pressure on the lower ribs (Fig. 77). Then the operator, with one hand on the patient's free arm, near the shoulder, and the other placed under or in front of the corresponding hip bone, rolls the body from face downward to its side and a little beyond (Fig. 78). An assistant aids in this movement by handling the head and underlying arm. When the body has been thus rolled somewhat more than

half round, the chest becomes relieved from superincumbent weight, and a certain volume of air enters. After resting a second or two in this attitude of inspiration, the patient is returned to the prone position, and pressure made along the ribs to imitate the expiratory act.

Drowning: There are wide differences of opinion as to how long a man may remain under water after drowning and yet be resuscitated. It is probable that five minutes is the limit, but inasmuch as no record is usually kept of the time and it may be actually much less than what it appears under the influence of excitement, it is well to make an effort at artificial respiration unless the time is actually known to have been greater than a quarter of an hour.

FIG. 79.—Getting Water Out of the Lungs.

To clear the lungs of water preliminary to artificial respiration turn the patient on his face with his forehead resting on his wrist and a roll of clothing under his chest; then getting astride the body press on the back to force out the water; next drop your hands under his abdomen and lift up his body with the head hanging down so that the water will run out (Fig. 79).

Besides artificial respiration it is necessary to restore the heat of

the body, which is rapidly lost by immersion in the water, and to stimulate the circulation.

While efforts at artificial respiration are going on remove the wet clothing, wrap the body in dry, hot blankets, apply hot-water bottles to the feet, and rub the limbs actively toward the heart, stimulants should be given hypodermically, by the rectum, and by the mouth when the patient can swallow.

When respiration is established put the patient in a hot bath until the body heat and circulation are restored. Even when artificial respiration is successful after drowning, congestion of the lungs, bronchitis, or pneumonia is apt to result from the cold and the irritation of the lungs by the water which has gotten into them; to prevent these complications large mustard plasters should be applied to the chest.

CHAPTER IX

POISONING

Poisons may be divided into two classes, ***those which are taken internally or hypodermically*** and ***those which are applied to the skin.***

Of those taken internally the ***caustic acids and alkalies*** may also be applied to the skin; in either case they produce burns. When swallowed the burns are upon the lips, in the mouth, throat, and stomach. The stains are seen upon the lips, and the symptoms are intense pain and agony, and vomiting of bloody matter mixed with mucus and shreds of membrane. The ***treatment*** consists in trying to neutralize the poison, protecting the burnt surfaces by administering soothing substances such as oils, milk, white of egg, flour and water, etc., and relief of pain by opiates.

The *caustic alkalies,* such as lye, are best neutralized by vinegar or lemon juice and water, and the *caustic acids,* such as sulphuric and nitric, by magnesia, cooking or washing soda, tooth powder, or soap suds. The remainder of the internal poisons may be divided in three general classes:

1. *Those whose principal effect is upon the gastric-intestinal canal, causing violent irritation or inflammation;* such as arsenic, corrosive sublimate, nitrate of silver, oxalic acid, croton oil, and sugar of lead.

2. *Those which produce little or no local irritation, but have a powerful general effect, especially upon the nervous system;* such as opium, chloral, belladonna, prussic acid, and strychnine.

3. *Those which are both local and general poisons;* such as phenol, cantharides, phosphorus, and aconite.

In the *treatment* of cases of poisoning our first object is to empty the stomach and prevent the absorption of any poison that may be left in it; then to relieve pain and obviate the tendency to death.

An emetic is ordinarily used to empty the stomach, and those which are most readily available are warm water, mustard, salt, and ipecac; give a tablespoonful of mustard or salt or a half-teaspoonful of ipecac dissolved in a half-pint of tepid water; encourage vomiting

by running the fingers down the throat or tickling it with a feather; the water should be tepid to produce nausea, and vomiting should be repeated until the water returns clear. If a stomach tube is available the stomach should be washed out.

To prevent absorption we give an antidote, that is something that will destroy the poison or its effects, usually rendering it insoluble.

Antidotes are general and special. The *general antidotes* are given when we do not know the exact nature of the poison; thus tannic acid and substances such as tea which contain it are antidotal to the poisonous alkaloids and therefore to most vegetable poisons, and albumin and substances such as white of egg, milk, etc., which contain it are antidotal to most mineral poisons. The *special antidotes* should be used when we know the exact nature of the poison; hydrated magnesia or hydrated oxide of iron is the special antidote to arsenic, salt to the nitrate of silver, chalk or tooth powder to oxalic acid, soluble sulphates such as Epsom or Glauber's salts to phenol and sugar of lead, sulphate of copper to phosphorus, and permanganate of potash to opium.

The antidote is given at the same time as or immediately after the emetic.

The relief of suffering calls for soothing, bland liquids, such as olive oil or milk when there is burning pain in the stomach and bowels, and also for morphine hypodermically.

To obviate the tendency to death observe in what way life is threatened and endeavor to counteract that effect. If there is shock and collapse, use stimulants, warmth, and rubbing; if the heart is failing as in poisoning by aconite, chloral, or prussic acid stimulate it by hot coffee, strychnine, digitalis, etc.; if there is failure of respiration as in phenol poisoning use coffee, cold douching, and artificial respiration; if there are violent convulsions as in strychnine poisoning use bromides, chloral, or chloroform; if there is tendency to sleep keep the patient awake by the administration of coffee, slapping the face and chest with a wet towel, and walking him about.

To sum up: *if you do not know what the poison is, but there are signs of burning or caustic action about the mouth and lips, do not give an emetic,* give a tablespoonful of bland oil, such as olive oil or cottonseed oil, or castor or cod-liver oil; get the patient to bed, relieve his pain, put mustard plaster over the stomach, and try to keep him alive. You do not give an emetic in such cases because the burned

stomach might give way in vomiting, and the caustic would burn as much coming up as it did going down.

If you do not know what the poison is, but the lips and mouth are not burned, give an emetic followed by two or three raw eggs, a glass of milk, or flour and water, and then a cup of strong, hot tea, after which relieve pain and obviate the tendency to death.

When you do know the poison give the emetic, and the antidote; then relieve pain and keep the patient alive.

Among the substances which most commonly cause poisoning are phenol, opium, wood alcohol, foods, chloral, arsenic, corrosive sublimate, nitrate of silver, phosphorus, and strychnine.

Phenol is usually taken in concentrated form, and may produce death in an hour or two. The symptoms are white patches on the lips, burning pain in the stomach, intense depression, cold, clammy skin, weak pulse, failing respiration, stupor, and death. The antidotes are the soluble sulphates, and albumen but they cannot be depended upon. Give emetics, then wash out the stomach thoroughly with water containing about two ounces of Epsom or Glauber's salts, then give two raw eggs or a pint of milk. Perform artificial respiration and use stimulants, heat, and rubbing.

When phenol is dropped on the skin, alcohol, if used promptly, will completely prevent any burning.

Opium.— The treatment of opium poisoning has been described on page 129.

Wood alcohol or methyl alcohol is a very dangerous poison used as a fuel, and in the manufacture of toilet preparations such as bay rum. The symptoms of poisoning by it are severe pains in the head and abdomen, dizziness, vomiting, delirium, partial or complete blindness, dilated pupils, great depression of the heart and respiration, sometimes albuminuria, stupor, and death. If the patient recovers he is often left blind.

The treatment consists in use of emetics, or washing out the stomach, emptying the bowels by cathartics and enema, active stimulation by whisky and coffee internally and strychnine hypodermically, artificial respiration if necessary, and external warmth.

Ptomaine poisoning is usually due to the use of foods which have undergone partial decomposition, though there may be no change in their taste or odor. The poisonous decomposition is especially apt to occur in hashes, milk, or foods containing milk which have been kept

over night in warm weather. Sausage, cheese, and shell-fish sometimes undergo the same changes. Many cases of poisoning of this kind have occurred at military posts; sometimes whole companies have been poisoned at the same time.

The symptoms are much like those of wood-alcohol poisoning, only vision is not usually affected and there may be some fever and some purging.

In treatment the first thing to do is to empty the stomach and bowels of the poison by the use of emetics and active cathartics. Then relieve pain and give stimulants with heat externally and mustard plasters over the abdomen.

Chloral is the drug usually employed to make "*knockout drops.*" It causes deep sleep followed by insensibility, with failure of the heart and sometimes the respiration. Empty the stomach and keep the patient awake by the same means as in opium poisoning, except that on account of his weak heart the patient must not be made to walk about as in opium poisoning, and for the same reason strychnine must be freely used hypodermically.

In arsenic poisoning there is great pain in the abdomen, with vomiting and purging, tenderness, straining and perhaps suppression of urine, severe depression and anxiety, weak, rapid pulse, and cold, clammy skin. Use emetics or the lavage tube, give a tablespoonful of freshly prepared *hydrated oxide of iron* every ten minutes for five or six doses. The hydrated oxide is prepared by precipitating the tincture of the chloride of iron with aqua ammonia, and washing the precipitate to remove the excess of ammonia. Then give morphine, stimulants, and soothing drinks, with external heat and friction.

Corrosive sublimate may be swallowed by mistake in the form of an antiseptic solution. The symptoms are about the same as in arsenic poisoning and the treatment is much the same except that the *antidote is albumen* instead of hydrated oxide of iron, and that the antidotal effect is only temporary so that emetics must be used after the antidote.

Nitrate of silver may be swallowed accidentally as when a piece of lunar caustic breaks off and drops down the throat. Common table *salt dissolved in water* should be given freely; it is at once a special antidote and an emetic.

Phosphorus is sometimes taken in the form of match-heads. It

is an irritant poison like arsenic and corrosive sublimate. *Sulphate of copper is the antidote* and also an emetic; it should be given one-fifth of a gram every five or ten minutes with tepid water.

Phosphorus is the one irritant mineral poison for which oils should not be given because its absorption is favored by them.

Strychnine causes violent convulsions with intervals of rest; there are also pains and cramps in the abdomen. Death is the result of asphyxia in the convulsions or exhaustion following them. *Use emetics* or the lavage tube, *bromides and chloral, chloroform.*

Substances which produce poisoning when applied to the skin are chiefly plants of the *rhus family* such as "poison oak," "poison ivy," and "poison sumac." Other plants such as the common garden parsnip produce poisoning occasionally.

Some persons are not susceptible while other persons are so much so that they appear to be poisoned even without actual contact. "Poison oak" is a stubby plant with three leaflets notched on the edge and downy on the under surface; "poison ivy" climbs on rocks and trees; it is distinguished from "Virginia creeper," which it resembles, by having three leaflets instead of five and by having a hairy trunk and little clusters of white berries; "poison sumac" is distinguished from the harmless variety by having white berries instead of red. The symptoms of *rhus poisoning* are an inflammation of the skin closely resembling erysipelas, redness, swelling, burning and itching, sometimes vesicles; it is especially apt to occur on exposed parts such as the face and hands.

The treatment consists in dissolving off any remaining poison with alcohol and then applying alkaline lotions, such as a saturated *solution of bicarbonate of soda.*

PART IV

NURSING

NURSING in post and field hospitals is ordinarily done by members of the hospital corps. In general hospitals, base hospitals, and other fixed hospitals of active service it is done by the nurse corps (female) and the hospital corps.

The conditions most essential to the recovery of the sick are rest, absolute cleanliness, and an abundance of fresh air, and these the nurse should always seek to secure. Not all hospital corps men are fit to become nurses, but all must receive training in this subject in order to show whether or not they possess the aptitude. Study and experience are both necessary and the two must go together.

CHAPTER I

THE WARD

THE wards of all *post hospitals* are arranged on the same general plan.

The number of beds in each ward varies from twelve to eighteen and usually there is connected with each a toilet-room with baths, basins and water-closets, and a wardmaster's room. Near the ward is a room or cabinet for patients' effects, and a linen closet sufficient to contain enough linen for current ward use.

The beds are arranged in pairs between adjacent windows, with a space of three feet between the beds and three and a half feet between each pair of beds. About 100 feet of floor space and 1,200 cubic feet of air space are allowed to each bed; in the tropics this should be increased to about 150 square feet floor space and 3,000 cubic feet of air space; in wards for infectious diseases the floor space should be the same as that allowed for the tropics.

Between each pair of beds is a chair, and adjoining each bed a glass and iron bedside table; this with a folding bed-screen constitutes the official furniture of the ward which is purposely made as free as possible from appliances which are not only useless but collecting places for dirt and disease germs. Usually, however, there is a table for the wardmaster or nurse, and another with a small cabinet to contain ward medicines.

Fig. 80.—Window Ventilation; board below lower sash.

Field hospitals, which have an ordinary capacity of 216 beds, are for temporary use only, to supply shelter, food, and emergency treatment and are, therefore, not supplied with cots or furniture; the patients are placed on straw, covered by blankets.

The post hospital ward is heated by hot water or steam and ventilated by special openings for entrance and exit of air. These air shafts are calculated to introduce three thousand six hundred cubic feet of fresh air per hour per patient. The entering air is warmed by passing over hot-water coils beneath the floor, while foul air escapes through shafts artificially heated by hot-water pipes so as to produce an up draught.

When no special arrangements are made for *ventilation* the natural openings of the ward, such as doors and windows, are used for the purpose. The object must be to introduce as much fresh air as possible without reducing the temperature of the ward below the normal standard of 68° to 70° F., and without causing unpleasant draughts.

Fig. 81.—Window Ventilation; board above sash.

One of the simplest plans to secure *ventilation* when this is not specially provided for is to place a board under the raised lower sash, the air passing in between the sashes (Fig. 80), or to pull down the upper sash and protect the opening by a sloping board (Fig. 81). In either case the cold entering air is directed upward. Occasionally it is necessary to flush out the ward by opening wide the doors and windows for a few minutes; in such cases the patients should be thoroughly wrapped up as if out of doors.

Each ward is under the care of a noncommissioned officer or

private first class assigned as *wardmaster,* who is responsible for the comfort, diet, and medication of the patients, the performance of their duty by the nurses, the preservation of the ward property, the regulation of the heat, lights, and ventilation, and the cleanliness of the bed linen and clothing, lavatories, baths, water closets, etc. One nurse is sufficient for a ward of twenty beds when the cases are not of an acute character, but two may be required under special conditions.

The wardmaster or nurse accompanies the medical officer on his rounds, takes down his directions in the ward book, and sees that they are carried out. Each nurse has specified duties assigned to him, so that each may know exactly what is expected of him. He should from the first cultivate habits of observation, neatness, and system. Each time he passes about his ward he should observe the condition of his patients, the beds, chairs, tables, etc., and should at once correct anything that is out of order. There should be a place for everything and everything in its place. When anything has been used it should at once be cleaned and put back where it belongs, so that when occasion for its use comes again no time may be lost in looking for it and cleaning it.

When a medical officer unattended by a noncommissioned officer enters the ward the wardmaster should at once arise and call *attention* and at the same time approach the medical officer to render any assistance he may require; the same courtesy must be rendered the commanding officer of the post or other authorized inspector.

When strangers enter the ward he should ascertain their business and show them proper courtesies; they should not be allowed to wander through the ward by themselves.

A wardmaster should never leave his ward without informing his senior nurse where he is going and for how long and placing the latter formally in charge.

The tour of a *night nurse's* duty usually extends from immediately after dinner until after breakfast the following morning. The day nurses serve the dinner to the patients and the night nurses the breakfast; each completes his own work and cleans up everything that has been used by him during his tour of service. The night nurse renders a written report of all that has happened during the night and turns over to the day nurse any instructions he may have received.

In each ward a book should be kept containing a complete inventory of all the ward furniture, bedding, and appliances; when any of these articles become soiled, worn out, or broken they are exchanged for clean or new ones, but the number of each should as far as possible be maintained unchanged.

When a wardmaster is relieved in a ward he should turn over the articles to his successor and take his receipt in the book.

Going on duty in the morning the nurse must begin at once to get things in order for the morning rounds, usually at nine o'clock. Chairs should be put in their places, bedside tables cleared of superfluous articles, and beds made up. Bed patients should have their hands, faces, and teeth washed, and hair brushed. Convalescents who are able to do so may be required to assist in the ward work.

The floors should be dusted with a floor brush covered with a cloth wrung out of five per cent phenol solution and quickly polished with the polishing brush, and if of tile scrubbed with soap and water as often as necessary, and the chairs, tables, beds, and windowsills freed from dust by a cloth dampened in the same solution.

Hospital floors should be made as impervious as possible, so that they may not absorb germs and dirt. They ordinarily have a hard finish and are kept smooth and polished by using on them a solution of paraffin or paraffin and wax in turpentine, and frequent polishing with a weighted polishing brush covered with a piece of blanket. A commonly used preparation consists of six ounces of paraffin dissolved in a gallon of turpentine, with the addition of an ounce of soft soap just before using; this is applied with a mop, and when dry is rubbed in with the floor polisher.

A floor so finished should not be scrubbed with water; spots may be removed with turpentine.

After the ward is made ready the lavatory should be attended to; all urinals, bed pans, and bottles should be thoroughly cleaned, shelves wiped off, closet-bowls and seats washed, and bath tubs scrubbed.

To clean brass, copper and nickel, a mixture of oxalic acid, alcohol and kerosene is very effective; for enameled ware use soap and hot water, removing stains with chlorinated lime.

For porcelain utensils never use sapolio, oxalic acid or strong alkalies; they destroy the enamel; warm water and soap, followed by kerosene, are best.

In addition to this daily cleaning a more thorough preparation is made for Saturday inspection. The walls, window borders, and all projections and corners, should be brushed with a soft long-handled brush covered with a damp cloth. Windows and sills, tables, chairs, and unoccupied beds are washed, and cots and mattresses gone over for bed-bugs.

To destroy bed-bugs a saturated solution of phenol, or kerosene oil is usually employed, the solution or kerosene being freely applied in all cracks and crevices and along the seams of mattresses. Hydrocyanic acid gas is very useful for the destruction of bed-bugs, flies, cockroaches, and other vermin which may infest hospitals. The gas is generated from cyanide of potash by the addition of commercial sulphuric acid. An ounce each of cyanide of potash and sulphuric acid and two ounces of water are required for each hundred cubic feet of air space, and the apartment must be tightly closed for six to eight hours in the same manner as in fumigation with sulphur or pyrethrum. The objection of cyanide fumigation is the great danger to human life from breathing the fumes of the gas, which precludes its employment in any part of an occupied house, or in a house in a block separated from other houses by party walls only.

Beds and mattresses, however, may be freed from insects by fumigating them in a tightly constructed chamber or box such as is used for disinfecting objects with formaldehyde gas. The room having been made ready, the proper amount of sulphuric acid and water is placed in a porcelain basin or slop jar to which is quickly added a thin paper bag containing the corresponding quantity of cyanide of potash; the operator then *immediately* leaves the room and closes the door. After six to eight hours the door is thrown open for the escape of the gas and the entrance of fresh air, and on no account must any one enter the room until the ordor of the gas has practically disappeared.

It must never be forgotten that this gas is absolutely deadly to human life, and that even a momentary exposure to it may be fatal.

Whenever a bed is vacated mattress and bedding should be thoroughly aired and sunned, and disinfected if necessary. The same bed linen should never be used, without washing, for two consecutive patients.

In addition to the daily and weekly cleaning there should be a

thorough disinfection of the wards twice a year or whenever infected.

To prevent the pollution of the ward air, all discharges, such as urine, feces, sputum, and vomited matter, soiled dressings and linen, and dirty vessels should be promptly removed. The vessel containing discharges should be covered at once, using a piece of rubber sheeting or a towel if the vessel has no cover, and should never be carried through the ward uncovered.

Soiled dressings should be received in a covered pail or paper bag and promptly burned.

Sputum cups in use should be frequently disinfected by boiling, and bed pans and urinals scalded with hot water after each use and always kept clean.

CHAPTER II

WARD MANAGEMENT

A PATIENT may be able to walk to the hospital or he may be brought there in an ambulance or on a litter. In either case he should be examined at once by the senior noncommissioned officer present; if he has been seen already by a medical officer direction for his disposition should accompany him; if he has not been seen by a medical officer one should be notified promptly. Pending his arrival the noncommissioned officer should take the necessary steps, taking care that no contagious case goes into the general wards. Generally there is a standing rule in hospitals that all patients should be given a bath before being put to bed unless there are orders to the contrary or the patient's condition is such as to render a bath undesirable. After the bath the patient is given a suit of hospital clothing and put to bed. An inventory of his effects is made in duplicate and signed by the wardmaster, one copy in a book and the other on a name slip which is attached to the bundle.[1] Take everything out of the patient's pockets and place all valuables such as money, watches, jewelry, etc., in a separate package, on which should be written the name of the patient, number of the room and of the ward, the date, and a list of the effects; the package should be at once sent to the office for safe keeping. The clothing is then inspected and if it requires disinfection is at once sent to the disinfecting chamber; otherwise the underclothing should go to the laundry and the remainder, tied securely in a bundle, to the locker corresponding to the patient's bed. Valuables should be listed, placed in an envelope marked with the name, date, and contents, and at once turned over to the senior noncommissioned officer for deposit in the hospital safe. Meantime it is well to offer the patient a glass of water or milk to make him feel that he is being cared for. After the patient is comfortably in bed, his pulse, temperature, and respiration are taken and recorded; the first urine passed is saved in a clean vessel for examination.

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1 In the larger hospitals a property card is filled out by the wardmaster, and, together with one of duplicate tags, numbered serially, attached to the property; the other tag is given to the patient.

Bed patients should wear hospital clothing only; but, on the other hand, patients allowed up should not be permitted to wear hospital gowns or pajamas under their own clothes; unless this point is looked to, hospital clothing will often be missing.

Food and medicines must be administered promptly and in a proper way.

Fig. 82.— Bed Tray.

The nurses' hands must be kept clean and free from odors. Nothing is more disgusting to one who is already ill than to have food presented from dirty hands.

One of the most important duties about the hospital and perhaps the one most frequently neglected is the *serving of diets*. The noncommissioned officer in charge of the mess is responsible under the senior noncommissioned officer and should be in the wards at meal times to see personally that the diets are promptly and properly served. Utensils should be clean, plates warmed, and no slopping over allowed. Food which is intended to be hot should reach the patient in that condition. Used utensils and unconsumed food should be promptly removed from the ward and all crumbs and débris cleaned up.

Patients able to sit up in bed use the bed tray (Fig. 82), those unable to sit up must be fed by the nurse. To administer liquids the head and shoulders are raised and a feeding cup (Fig. 83) or an ordinary cup or tumbler is used. When the head should not be raised the liquid may be taken through a bent glass tube. When the sick man is unconscious, liquids must be given very slowly, taking care to avoid choking.

Fig. 83.— Feeding Cup.

Utensils used for patients with infectious diseases must be kept separate from others and separately washed. Especially is this important in the case of syphilitics with mucous patches in the mouth, and in typhoid fever cases.

Very ill patients on liquid diet should have their nourishment regu-

larly at night as well as by day unless there are special orders that the patient shall not be awakened. Very often wakefulness is due to insufficient nourishment, and a glass of milk or a cup of beef tea will often secure several additional hours of sleep.

Liquid diet includes only liquids, the most useful of which are milk, meat extracts, broths, gruels, albumen solutions, and, last, but not least, water.

Milk by reason of containing a proper proportion of all the important food principles is by far the most valuable single article of liquid diet. It may be given in many forms: Plain, peptonized, as buttermilk, whey, or junket; a patient on milk diet alone should take from two to five pints in the twenty-four hours.

Meat extracts have little value except as stimulants; it should never be forgotten that a patient fed exclusively on them would promptly starve; the same remark applies, in a less degree, to broths and gruels. Albumen water is valuable when milk is not tolerated. In all diseases, but especially in fevers, water in large quantities is indispensable; it flushes out the excretory organs, removing poisonous substances, aids the circulation, and lowers temperature in its evaporation from the skin. In all fever cases the amount of water given should be noted on the clinical record.

Medicines must never be left with a patient to be taken by him; the nurse should give them himself and see that they are swallowed before he leaves the bedside. In giving medicines great care must be exercised to avoid mistakes. The label indicating the nature of the medicine and the dose must be carefully read, the bottle shaken, and the dose measured out by pouring from the side of the bottle opposite the label so as not to spoil the latter. After the dose is taken the fact should be recorded, never before. A graduated medicine glass should always be used to measure doses instead of spoons which vary so much in size. Medicines ordered to be taken before meals should be given about twenty minutes before, while those to be taken after meals should usually be given immediately after. Sour medicine should not be given within a half-hour of the time when milk is administered. Sleeping patients should not be aroused to take medicine unless the medical officer has specially so ordered.

Pills are administered by putting them far back on the patient's tongue and giving him a swallow of water.

A powder if small should be placed on the back of the tongue and washed down with water or placed on a spoon and moistened with water; if large and bulky it should be stirred up with water in a tumbler and swallowed quickly before it settles.

The *ward medicine closet* must be kept locked and the wardmaster must take care to avoid an accumulation of medicines. When a patient for whom a mixture has been especially ordered leaves the ward his medicine bottle should be at once turned in to the dispensary, and the same rule applies to all medicines not in current use.

To give medicines subcutaneously, the *hypodermic syringe* is used. Certain rules are necessary to prevent accidents with this instrument. The solution used must be freshly prepared; the needles must be clean, sharp, and aseptic; the syringe freshly sterilized; the skin where the injection is made must be cleansed.

To render the needle aseptic boil it a moment in a spoonful of water, or draw phenol or cresol solution through it several times. Disinfect the syringe in the same way, or use 70% alcohol. Never attempt to use a needle the point of which is dulled or bent. In making the injection care must be taken to avoid blood-vessels, nerves, and bones; for this reason a fleshy part should always be selected and the injection made obliquely; the outside of the forearm or the front of the thigh is usually chosen.

Draw the medicine into the syringe, screw on the needle, hold the syringe vertically, needle up, and gradually press the piston until all air has been forced out as indicated by the escape of a drop of fluid; wash the skin at the point of injection with a little alcohol or plain soap and water, draw the skin tight, and thrust in the needle quickly. When the needle has penetrated about half an inch, force out the liquid slowly, withdraw the needle, and press the finger for a moment on the puncture. Before putting the syringe away draw a disinfecting solution through it, remove the needle, force out the last drop of fluid, and at once insert the wire.

The *bed pan* should be warmed before use by dipping it in hot water or placing hot water in it for a few minutes; as soon as removed from the patient it should be promptly covered, taken from the ward, emptied, and washed.

Rubber sheets should never be folded, as to do so will crack them; when not in use, hang by the edges or roll on a wooden roller.

The patient's nails should be kept clean and special attention should

be paid to his mouth and teeth. The teeth and mouth of helpless patients should be washed with a gauze sponge dipped in a mild antiseptic solution.

Dying patients should preferably be removed to a separate room; but if this is not practicable their beds should be surrounded by screens so that the other patients may not be unfavorably affected by the sight. A medical officer should always be notified. As soon as death occurs the body should be removed with as little disturbance as possible and given proper attention.

The *signs of death* are cessation of respiration and of the heart's action, dilatation of the pupils with flaccidity of the cornea, and later coldness of the body, rigor mortis, and decomposition.

When respiration can no longer be seen its complete cessation may be verified by holding a mirror over the mouth; if there is any breathing at all the mirror will be clouded. When the heart and pulse can no longer be felt, tying a string around the finger will show whether the circulation has ceased; if it has not there will be some congestion of the end of the finger, while there will be no change if death has occurred.

In hospitals the sign of death most relied upon is the sudden and permanent dilatation of the pupils with flaccidity of the cornea; the latter sign is elicited by touching the cornea with the finger, when, instead of being firm and resilient, it will be found soft and flaccid.

As soon as the body is removed from the ward the rectum, mouth and nostrils must be packed with cotton to avoid post mortem discharges, a triangular bandage with an absorbent cotton pad applied to the perineum, and the limbs straightened out and placed in position before *rigor mortis* or stiffening sets in. A little cotton should be placed under the upper lids which are then closed. To prevent the jaw from dropping, a four-tailed bandage is applied to the chin, or a rolled-up bandage is fixed between the chin and sternum. The body is then wrapped in a sheet wet with an antiseptic solution and in hot weather placed in an ice box.

Should an *autopsy* be necessary preparations are made for it. The body is placed on a table in the dead-house; the post-mortem case is procured and the instruments laid out; the other arrangements necessary are three pails, one containing water, another to receive discharges, and the third for specimens which it may be desired to keep; a large bath sponge, two pairs of rubber gloves, basin with water, towels, strong thread and needles.

CHAPTER III

BEDS AND BED-MAKING

THE regulation hospital bed is of white enameled iron with wire springs, and is excellent in every way. The mattress is of hair in three sections fastened together by straps, so that the soiling or destruction of one section does not necessitate the loss of the entire mattress; further to protect the mattress each is supplied with a movable cover which should always be used.

The bed covering should be warm but light; counterpanes being heavy and not porous are objectionable, and for occupied beds should be replaced by sheets.

To prepare a hospital bed first see that the springs are in good condition and not sagging; then select a good mattress free from hollows, cover it with a mattress cover, and place on the springs. Over the mattress spread a sheet, tucking it in first at the head and foot and then at the sides.

If the patient is liable to soil the bed a *draw sheet* comes next, otherwise it is omitted. The draw sheet consists of a rubber sheet about three by four feet, covered by a folded cotton sheet and spread across the bed where the hips will rest, and tucked in at the sides or pinned to the mattress. Over this is placed the upper sheet and blankets, and over the latter for their protection another sheet is spread; to protect the upper edge of the blankets from soiling, the outer sheet or spread is folded over it, and finally the upper inside sheet folded back over the outer one.

When a patient is placed in bed always pull out the covers a little at the foot of the bed, so that they may not press upon his upturned feet; this is a little point, often neglected, but meaning much to the patient.

All of the beds in a ward should be prepared in the same way so as to give a neat and uniform appearance. Patients are very fond of tucking things away under the mattress, a practice which should be carefully prevented by frequent search.

The bed linen of an occupied bed may be changed easily by a

single nurse unassisted and that without seriously disturbing the patient. To change the lower sheet, first loosen all the bed clothes at top, sides, and bottom, remove all the upper covering except a sheet and blanket, and roll up the bottom sheet lengthwise together with the draw sheet into a tight roll close to the patient's body; then in like manner make one side of the clean sheet and draw sheet into a roll and place it alongside the first roll, tucking the free edges under the mattress. Now stand on the other side of the bed and with both hands turn the patient on his side with his face toward you; tuck in the rolls under his back, turn him back on his other side on to the clean sheet, then withdraw the soiled one and pull the clean sheet into place.

To remove the upper bedclothing the covers should first be loosened as before, then spread the clean sheet and blanket over them and tuck in at the sides, after which the soiled clothes may be drawn out at the foot.

Bed linen should be changed whenever it is soiled, when a patient is discharged, and at least once a week, depending on the nature of the case; in the infectious fevers it may be necessary to change daily. Even when the sheets are not changed they should be drawn tight and straightened up daily.

Sometimes it is more convenient to move the patient to a fresh bed so that the other may be aired and changed; this may be done in several ways. The two beds may be moved close alongside of each other and the patient gently lifted over on the sheet by two attendants, one at the head and the other at the foot; the lifting may be facilitated by rolling the edges of the sheet around a pole on each side, thus forming an improvised litter.

If there is only one attendant a rubber sheet may be pinned to the occupied bed and stretched across the interval to form a smooth surface on which the patient is pulled over on his own sheet; or the mattress on which the patient is lying may be pulled a little way over the other and the patient then rolled over the edge or drawn over on his own sheet. Where there is only one bed and the mattress is to be changed draw the soiled mattress half way off, and then place the clean one alongside; draw the patient on his sheet from the soiled to the clean mattress, remove the soiled one, and draw the clean mattress in its place.

A *bed is prepared for an operative case* the same as for any other

with the following differences: The pillow is removed and a small rubber sheet covered by a towel pinned to the mattress in its place, this because nausea is less apt to occur if the head is low; in case there should be vomiting a couple of towels are hung over the head of the bed and a basin, several mouth-wipes and a mouth-gag or tongue depressor placed on the bedside table. A number of hot-water bags are placed in the bed, and a blanket is put under the upper sheet; the object of these procedures is to diminish shock by having the bed as warm as possible. Before the patient is placed in the bed the hot-water bags are removed lest the patient in his unconscious condition should be burned without knowing it. The covers on one side of the bed should be turned back to the edge of the mattress in order that the bed may be quickly opened up for the reception of the patient.

Beds for fractures of the lower extremities should be firm and solid so that the sinking in of the bed from the weight of the body may not cause displacement of apparatus and in order that the patient may be better handled; this is accomplished by placing under the mattress a frame of slats or a number of separate wooden slats. A great variety of fracture beds and invalid beds have been invented, but they are all too complicated, and an extemporized bed is better.

To move a patient from one side of the bed to another; standing on the left side, pass the right arm well under the patient's shoulder and back, so that his shoulder will rest upon that of the nurse, and pass the other hand over the patient's other shoulder; lift gently and move over the upper half of the body; then place the right arm under the back lower down, and the left below the hips, and move the lower half of the body over. Whenever the hips are to be moved, always flex the patient's knees, and place the feet upon the bed; this enables the patient to help and lighten the weight. When lifting the shoulders support the head in the hollow of your arm. When moving the patient to one side of the bed always move him toward you.

To lift to the upper part of the bed pass the right arm obliquely under the patient's shoulder and back and the left below the hips and lift toward the head. If the patient is strong enough to clasp his arms around the nurse's neck he can assist considerably in these movements.

To change the pillows one arm should raise the shoulders and head, while the other hand adjusts the pillows.

To raise the patient to a semi-recumbent position a bed-rest may be used; or a straight-backed chair turned bottom side up and padded with pillows answers very well, or the support may be made of pillows entirely, the first being placed low down beneath the back and the others packed in above.

Where there is a tendency to slip down in bed, a firm cylindrical pillow about eight inches in diameter is used; this is placed beneath the patient's knees and firmly tied to the head of the bed by broad bandages fastened to the pillow at each end.

Rubber cushions of various shapes and sizes are very useful about a sick-bed, and when there are involuntary discharges a " Kelly pad " or surgical pad is invaluable.

In cases of paralysis or other cases requiring long confinement to bed *air mattresses and water mattresses* are used. The air mattresses may be placed on an ordinary bedstead and inflated with a bellows or by the mouth.

The water mattress requires a frame on each side of the bed to keep it from slipping off, and a rubber sheet must be spread over the springs to prevent sticking. After the mattress is in position it is filled with water by a hose or through a funnel; the temperature of the water must be not less than 98° F., that is, the temperature of the body. No pins should be used about water and air beds lest puncture and leakage occur.

When patients are confined to the bed for long periods of time and their vitality is at the same time very much lowered, as occurs in cases of paralysis, long-continued fever, and in old persons, *bed-sores* are very apt to form; starting as an inflammation of the skin, ulceration and sloughing soon follow and the destruction of tissue is often very deep, even laying bare the bone in many instances, and this with very little pain so that the patient may be unaware of the existence of the ulcers. The causes of bed-sores are long-continued and uneven pressure, frequent wetting of the skin, such as occurs in incontinence of urine, and uncleanliness. Constant watchfulness is necessary to avoid them in chronic bed cases, especially when the patient must remain in one position. It is much easier, however, to prevent bed-sores than to cure them. The beds must be kept clean and free from crumbs; the sheets and the patient's

night dress must be drawn smooth and free of wrinkles and should be changed whenever they get wet or soiled.

The parts of the body most liable to be affected are naturally those most subjected to pressure, the lower part of the back, the shoulders, elbows, and heels. These parts should be washed frequently with soap and water, thoroughly dried, and well sponged with alcohol, whisky, or a one-per-cent solution of tannic acid in whisky. After this lanolin may be rubbed in to make the skin supple, followed by dusting with talcum or starch to absorb moisture. In addition, pressure should be taken off the threatened points by frequent changes of position or the use of rubber rings; in the absence of rubber rings ring-shaped cushions may be made of cotton batting rolled in a tight cylinder, formed into a ring, and then wrapped with a roller bandage. In very chronic cases a water or air bed is necessary.

When the skin is reddened and apparently about to break, it may be protected by strapping with adhesive plaster or a thin layer of absorbent cotton may be placed over it and held in place with a coating of collodion.

After the bed-sore has formed it is treated like any other ulcer; wet antiseptic dressings are applied, and, after all sloughs have separated, balsam of Peru or other stimulating applications are used.

CHAPTER IV

BATHS AND BATHING

BATHS are given for several purposes, among the more important of which are:

1. To promote cleanliness.
2. To produce sweating or relaxation
3. To reduce fever.
4. To stimulate the circulation.
5. To quiet the nervous system.
6. For counter-irritation.

According to temperature baths may be:

1. Tepid; at temperature of the body; 98° F.
2. Hot; 100° to 110° F.
3. Cold; 90° to 70° F.

According to extent baths are classified as:

1. General.
   - *a.* Tub.
   - *b.* Sponge.
2. Local.
   - *a.* Sitz or pelvic.
   - *b.* Foot.

Besides water baths, hot-air and steam baths are employed. The wet pack is a modified form of bath.

To promote cleanliness tepid water is used either in the tub or by sponging.

To give a *sponge bath* in bed, cover the entire bed with a rubber sheet; on this place a blanket upon which the patient lies with another blanket or sheet over him; provide a pail of tepid water, a slop pail, basin, wash rag, soap, towels, ammonia, alcohol, mouth-wash, orange stick, nail brush, cotton, and comb. The bathing should be quickly done in sections, the rest of the body being meanwhile protected from exposure.

If the purpose of the sponge bath is to reduce temperature the water should be cold and the whole body may be exposed; in such

a case if the patient seems chilly after the bath a glass of hot milk or a little stimulant may be given.

The *sedative bath* is for the purpose of quieting excitement and inducing sleep; it may be continued for hours or even days; the temperature of the water is usually just below that of the body — about 96° F.

The arrangement is practically the same as for the Brandt bath, but to keep the water from cooling, the tub must be covered with a few pieces of board, on which are placed a rubber sheet and blankets; hot water must be carefully added from time to time to maintain a uniform temperature.

To produce sweating or relaxation, hot-water, hot-air, or steam baths are used.

The *hot water bath* is given in the tub in the ordinary way except that the head is kept cool by cold cloths or an ice bag. Care must

FIG. 84.— Bed Cradle from Barrel Hoops.

be taken not to continue the bath too long, to the point of fainting; fifteen to twenty minutes is sufficient, after which the patient is taken out and, without drying, placed on hot blankets and covered by three or four more which are wrapped closely about him up to the neck. Hot weak tea or hot water is given freely to encourage sweating. After about an hour the blankets are gradually removed, and the patient sponged off under the last one with alcohol and water, this being followed by a brisk rub with dry towels.

Hot air and steam baths may be given in bed or sitting up. In the first method the bed is covered with a rubber sheet upon which is placed a blanket on which the patient lies stripped. Over his body are placed two or three bed cradles or extemporized bed cradles

(Fig. 84). Bed cradles may be extemporized by tying together at right angles two half barrel-hoops. Over the cradles and tucked in about the patient's neck is another rubber sheet and blanket. At the foot of the bed is placed an oil, gas, electric, or alcohol heater with a section of stove pipe and an elbow to conduct the heat under the bedclothes, or, if steam is to be used, upon the heater is set a tea-kettle with a hose attached to the spout for the same purpose (Fig. 85). After the steam or hot air has passed in long enough to get perspiration well started, the upper rubber sheet and the cradles are removed and the blankets tucked in closely around the patient's body, after which the case is managed in the same manner as the hot-water bath.

To give these baths to a patient sitting up, after removing all clothing he is made to take his seat upon a chair with perforated bottom; under the chair is placed an alcohol lamp, an electric heater,

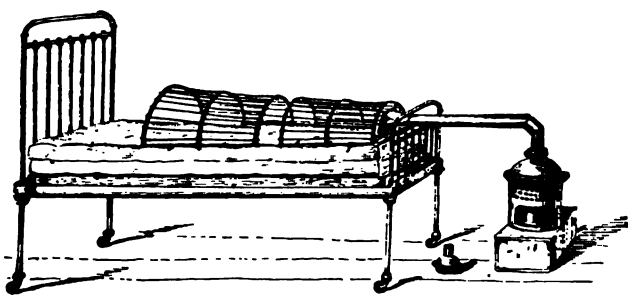

FIG. 85.— Arrangements for Hot-air or Vapor Baths in Bed.

or a pail of water in which are dropped hot stones or bricks. The patient is then surrounded from the neck downward by a rubber sheet and blankets arranged in the manner of a tent; this is a convient method in the field.

Precautions to be used with hot air or vapor baths:

1. Be careful not to burn or exhaust the patient, or to set fire to the bed.
2. Keep an ice-bag on his head.
3. Watch the pulse.
4. Give hot drinks freely.
5. Wrap the patient in a hot dry blanket for an hour after the bath, then rub with alcohol.

To reduce fever we use either the *Brandt system* of cold tub baths.

cold sponging, or the cold pack. There are also various extemporaneous methods for applying cold for this purpose. The general effect of cold baths, besides reducing the temperature, is to allay nervousness, quiet the circulation, increase excretion, and induce sleep.

The *Brandt system* of bathing is used chiefly in typhoid fever. A portable bath tub on wheels is generally employed. The tub is brought to the bedside half filled with water at a temperature of about 90° F.; the naked patient is lifted from the bed and lowered into the tub feet first, and gradually, so as not to produce too much shock. For the purpose of lifting the patient from the bed and supporting him in the tub an open-work stretcher, a hammock, or a cotton blanket with loops sewed in the edges, is usually employed; in the absence of these a binder eighteen inches broad should be fastened across the head of the tub to support the head and shoulders. His head rests upon a circular air cushion and is kept covered with cold compresses; pieces of ice are added to the water so as to reduce the temperature gradually to about 70° F. To ascertain the temperature accurately a bath thermometer is employed. All the time the patient is in the bath the attendants should keep up a vigorous rubbing of his body. The duration of the bath is ordinarily about twenty minutes, but it may be shortened if there is much shivering, and blueness of the lips and finger tips.

When it is time to take the patient out, the tub is covered with a dry sheet which is wrapped about the patient as he is lifted out, and placed on a dry blanket. If shivering persists a hot-water bag may be applied to the feet and a hot drink may be given internally, but he should not be wrapped in blankets. The temperature is taken in the rectum immediately after leaving the bath and again an hour later. Ordinarily the bath is repeated whenever the temperature goes above 102.5° to 103° F.

Cold sponging has already been described under the *sponge bath*.

When the patient does not stand the cold tub bath well or is too weak to bear the moving, the *cold pack* may be employed. In this method the bed is protected by a long rubber sheet, and two sheets folded one or more times and wrung out of water at 70° F. are used. One is placed under the patient and the other over him and tucked in closely about the body and neck; or a single sheet may be used enveloping the entire body except the head. The packs are

changed about every fifteen minutes, and three or four of them generally produce the effects of a single tub bath.

Bed tub-bath. To give a patient a bath in bed, pass under him a rubber sheet the size of the bed, a bed sheet, and over this a large rubber sheet about three feet wider and two and one-half to three feet longer than the mattress. Attach a small rope or cord to the head and foot of the bed, on each side, about six inches above the mattress, and stretch it firmly. Over this cord pass the large rubber sheet and fasten with clothes pins, thus forming a trough to carry off the water; direct the lower end of the rubber sheet into a pail at the foot of the bed, and raise the head of the bed a few inches on blocks.

Remove the top covers and place a towel over the patient. The water, of desired temperature, may be sprinkled on with a watering pot, or from a pitcher or a syphon connecting with a pail placed above the bed. If the bath is cold, patient should be well rubbed during its administration. After it is over, drain off the water, and with a towel wipe the rubber sheet dry, withdraw it from beneath, and dry the patient with the sheet on which he will then lie.

Alcohol baths. The patient is usually rubbed with alcohol after an ordinary bath, or it may be given alone, for its soothing and quieting effect. Fifty per cent alcohol is ordinarily employed, and is well rubbed in by the hands of the nurse. The bedding covering patient, except the sheet, should be removed, and the lower sheet protected by bath towels; the body is then gone over systematically, one portion at a time, using only enough alcohol to avoid wetting the bed. A pint will usually be sufficient for one bath.

In the field when the folding field tub is not available, substitutes may be extemporized. An ordinary camp cot may be taken, the canvas bottom punched full of holes and a piece of rubber sheeting tacked across the frame below the canvas in such a way that it will form a gutter draining toward a pail placed at the foot. On this cot the patient is to be placed and cold water sprinkled or poured over him; or an upright frame may be made, to the sides and ends of which rubber sheeting may be attached in such a way as to form an extemporized tub.

Bakes. Small hot air cabinets for baking different parts of the body are furnished by instrument makers, and especially adapted for the part to be baked.

It is necessary, in the use of these appliances, to strictly follow the directions and to take good care to avoid burning the patient. Special protectors are supplied for this purpose, but need to be closely watched.

Electric light baths. Special appliances are required for these baths, and directions for their use accompany them.

Local baths. The *foot bath* may be given in bed. It is employed in sprains to control the hemorrhage about the joint, and in internal diseases to draw away the blood from the congested part. For the latter purpose mustard is usually added to the hot water.

To give a mustard foot bath in bed turn up the covers from the foot end of the bed, place a rubber sheet across it, and on this a pail or foot tub full of water as hot as can be borne. Dissolve a couple of tablespoonfuls of mustard in a cupful of hot water until a uniform cream is formed and stir it into the pail of hot water. If the dry mustard is added to the pail of water without previous solution, particles of mustard will float around, adhere to the legs, and may produce blisters.

When all is ready the patient, lying on his back, should flex his legs and immerse them in the hot solution until the skin is quite red. The legs are then withdrawn, dried quickly, and wrapped in a blanket.

In the *Sitz bath* the patient sits in a tub or deep basin of hot water, the feet rest on the floor.

CHAPTER V

ENEMATA, IRRIGATIONS, DOUCHES, CATHETERIZATION

An *enema* is an injection of fluid into the bowels. When the injection is made into the rectum through a tube passed just within the anus it is known as a *low enema* or simply an enema; when the liquid is carried high up into the colon through a soft-rubber tube introduced fifteen or eighteen inches it is known as a *high enema.*

Enemata are further classified according to the purpose for which given, into laxative, nutrient, and medicinal or therapeutic enemata.

Laxative enemata are of various kinds according to the special indications of the case. The one most commonly used is composed of two or three pints of soap suds made with any good soap and water, either hot or cold. To give such an enema the patient is placed on his left side with the hips raised and resting upon a folded towel placed upon a rubber sheet for the protection of the bed. A bed pan or commode should be at hand, and also a towel to control the anus if necessary.

A rubber bulb or a fountain syringe may be used, the former being generally considered preferable on account of the intermittent pressure which it permits of; either, however, is effective and safe if properly used.

A soft rectal tube is attached to the tube of the injector by a short piece of glass tubing, the rectal tube lubricated with soft soap and then passed in gently for eight or ten inches. The fluid is made to pass in slowly, the bag in the case of the fountain syringe being raised or lowered as necessary so as not to cause any pain.

After the entire amount has passed in, the patient is directed to hold it for about fifteen or twenty minutes if possible, and may be assisted by pressing a towel firmly against the anus. The longer the fluid is retained the higher up the contractions of the bowel extend and the more complete the resulting evacuation. Should a more active enema be necessary thirty grammes of Epsom salts and fifteen Cc. of turpentine may be added to the soap suds, or sixty Cc. of castor oil and fifteen Cc. of turpentine may precede the suds by

half an hour. Fifteen Cc. of glycerin diluted with an equal amount of water, and given with a small hard-rubber syringe, makes a very effective enema.

Fig. 86.— Irrigation of the Bowels. First step.

The nutrient enema is always given high, as the rectum itself has very little absorbent power and still less digestive capacity; if the bowels are loaded they must first be emptied by a laxative enema. Nutrient enemata must not exceed one hundred and twenty-five Cc. in bulk so as not to cause peristalsis and lead to their own rejection; they must also be concentrated, nonirritant, and predigested or easily digestible. They should not be repeated oftener than once in four to six hours.

Among the food preparations most suitable for this purpose are peptonized milk with or without the addition of an egg, and beef juice or beef extract.

Water to relieve thirst is often given by high enema; for this purpose as much as a pint should be used, and it should be of body temperature so as to cause as little irritation as possible.

Fig. 87.— Irrigation of the Bowels. Second step.

A nutrient enema is given through a rectal tube or large catheter, warmed, well oiled, and introduced for about twelve to fifteen inches; in the outer end of the tube a funnel is placed, and the liquid food showly poured in from a pitcher. When nutrient enemata are given frequently the bowel should be gently washed out with warm water before each one; the tube and funnel are used for the washing, the latter being alternately raised and lowered before all the water has run out so as to secure siphon action.

Medicinal enemata may be given for their general effect as when chloral, opium, or stimulants are used, or for their local effect, on inflammation or hemorrhage, when astringents, emollients, or antiseptics are employed. The last class of medicines is, however, usually employed by irrigation instead of enema. The most common emollient enema is the well-known starch-and-laudanum mixture. To prepare it take a tablespoonful of ordinary laundry starch, add enough cold water to dissolve it, and then sufficient boiling water to form a thin paste; into this stir fifteen to twenty drops of laudanum, and inject while warm with a hard-rubber syringe.

An *irrigation* differs from an enema in that it is desired that a considerable portion of the liquid introduced shall be absorbed and that the remainder shall be allowed to flow away at once. The irrigation may be given for cleansing purposes only, or disinfectants such as nitrate of silver or quinine may be employed. Before the funnel is lowered, enough fluid should be introduced to gently distend the bowel without causing pain; it is important to see that the funnel is lowered while some fluid is still visible; otherwise there is difficulty in starting the outward flow (Figs. 86, 87).

The tubes and syringes used in giving enemata and irrigations must be kept thoroughly clean; for this purpose, after use a stream of water should be allowed to run over and through them, after which the syringe should be hung up to drip and the tubes and nozzles placed in an antiseptic solution. When the tubes or nozzles have been used in an infectious case they should be boiled before being employed for another patient.

Urethral injections are used in gonorrhea. In the hospital these injections are given under the supervision of the nurse, who should instruct the patient how to give them correctly. Having placed a basin on a chair in front of him or standing in front of the urinal, he should first pass his water to wash all the pus out of the urethra.

The syringe is then filled and the nozzle inserted in the meatus and held there firmly with thumb and forefinger of the left hand, after which the piston is driven slowly home, the syringe withdrawn, and the urethra firmly compressed for a couple of minutes in order to retain the injection. At least two syringefuls are used each time.

A *douche* is a stream or jet of water propelled with some force. Spinal, vaginal, nasal, pharyngeal, eye, and aural douches are employed, the latter being the most frequently used in military hospitals.

The *spinal douche*. The patient should sit on a board across the end of the tub furthest from the spigot and with his back toward the spigot. Use the spray as directed.

If the spray is to be hot test it first on your own arm.

FIG. 88.—Syringing the Ear.

If the patient is unable to sit up the douche may be given in bed which is prepared as for a *bed-bath*.

The *nasal douche*. Use a fountain syringe with a nasal tip. Incline the patient's head forward and to one side so that the nostril of entrance is uppermost; if one nostril is obstructed this should be the entrance; tell the patient to keep the mouth open and breathe through the mouth and not to cough or swallow, this to prevent the passage of the fluid into the eustachian tube; use no force; hold the irrigator only two or three inches above the patient's nose; have the water hot.

The *eye douche*. Use warm boric acid solution. Arrange the patient so that the eye to be douched is lower than the other one; wipe off any secretion with a wet cotton sponge from within out-

ward; evert one lid and direct the solution over it from within outward, holding the basin in such a position as to catch the flow; treat the other lid in the same way; if drops are to be put in afterward place them at the outer angle of the eye so that they will not immediately escape through the tear duct.

The aural or *ear douche* is used for cleansing purposes or to remove foreign bodies, especially hardened wax. Either a fountain syringe with a straight glass medicine dropper or a nozzle, or a hard-rubber syringe is employed. The former is to be preferred, as the pressure can be more easily regulated.

To remove hardened wax a warm, five-per-cent solution of soda is employed; the coat and collar of the patient having been removed and a towel placed about his neck, he sits in a chair with the head inclined toward the affected side; a basin or bowl is held firmly against the neck just below but not touching the lobe of the ear; the ear is then drawn upward and forward to straighten the canal, and the tip of the nozzle placed against the upper wall, along which the jet of water is directed with the object of passing behind the plug of wax and washing it out in the return flow along the floor of the ear (Fig. 88). A quart or more of water may be used at a time and repeated until the mass comes away in one piece or in fragments. When the wax is removed the ear should be dried out with a wisp of cotton, a little of which is left in the canal for a day or two until the sensitiveness has subsided.

Catheterization is the art of drawing off the urine from the bladder by the aid of a catheter. The dangers of catheterization are injury to the urethra from undue force, and cystitis or inflammation of the bladder caused by the introduction of germs on an unclean catheter. The precautions to be taken are absolute cleanliness of everything which may come in contact with the catheter and avoidance of all force in introduction. The catheter to be used should usually be of soft rubber only; failing with this a noncommissioned officer may use a silver instrument.

To introduce a soft-rubber catheter it is first washed in running water, then wrapped in gauze or a towel and boiled five minutes; the attendant washes his hands and the penis of the patient with hot water and soap, followed by an antiseptic solution, and surrounds the base of the penis with a clean towel; the catheter is then lubricated with sterilized oil, held in a dressing forceps, and gently passed

in until the escape of urine announces that it has reached the bladder. Should an obstruction be met with, the catheter is withdrawn a little, and again pushed on as before. After the flow of urine has ceased, the instrument is gently withdrawn, taking care to compress the end between the fingers as the last portion is withdrawn from the urethra in order to prevent the urine remaining in the catheter dripping out on the bed. After use the catheter should be thoroughly washed in running water and either hung up to dry or placed in a boric-acid solution.

Irrigation of the bladder for cystitis and other diseases, is done in much the same manner as irrigation of the intestines, using either a single or double current catheter.

Catheterization of the ureter is always done by the physician; the nurse's duties are to see to the sterilization of the instruments, and that specimens of the urine from the two kidneys are kept quite separate, for this purpose he marks the urethral catheter as well as the necessary vessels "right" and "left."

CHAPTER VI

EXTERNAL APPLICATIONS

AMONG the external applications most commonly used are heat and cold, lotions, counter-irritants, and caustics.

The application of heat may be general or local; the general application has already been described in Chapter IV. The local effects of heat are to relieve pain, allay inflammation, and relax spasm. *Dry heat* is applied in the form of the various dry hot-air apparatus, electric heaters, hot-water bags, bottles, or cans, salt bags and hop bags, hot bricks, etc. The dry hot-air apparatus must be used with considerable care and according to the directions which accompany each appliance. Bags, bottles or tins of hot water should be inclosed in a flannel cover or otherwise wrapped to prevent danger of burning; when used about unconscious or paralyzed patients especially, the greatest care and watchfulness should be employed to prevent accidents. Hot-water bags should be filled a little more than half full and all the air expelled before the top is screwed on; this makes them lighter and more easily adjusted. They should be examined closely before use to see that they do not leak. Hot bottles are not very safe, as they are apt to crack or burst. The great advantage of bricks is that they retain the heat a long time, but they are very heavy and awkward.

Moist heat is more penetrating and more relaxing than dry heat. It is applied in the form of poultices or fomentations or stupes.

Poultices are made of various materials; anything which will hold heat and moisture is adapted to the purpose; flaxseed meal is the time-honored basis for poultices, and where the skin is unbroken answers very well; but where a wound or abrasion exists such a poultice is a veritable culture-bed for bacteria, and should be replaced by layers of gauze wrung out of a hot antiseptic solution and covered by a layer of cotton batting and oiled silk.

To make a flaxseed poultice stir the meal slowly into boiling water until a thick paste is formed; boil for a few minutes, then

beat briskly with a spoon until the admixture of air makes it light; spread with a spatula or knife to the thickness of one-fourth or one-half inch upon strong muslin, leaving a free border of an inch all the way round. Then cover the face of the poultice with gauze, or oil it with vaseline, and turn over the edges. Apply, and cover with a layer of cotton and oil silk. Such a poultice should be changed once every two or three hours. The fresh poultice should be ready before the old one is removed, and they should never be used a second time. Oatmeal or cornmeal will do very well in the absence of flaxseed.

A *fomentation or stupe* consists of a couple of layers of flannel wrung out of hot water and covered with cotton and oil silk. A few drops of laudanum or turpentine are sometimes sprinkled upon the

FIG. 89.— Application of Cold Compresses to the Eye.

flannel after it is wrung out, or added to the hot water. To prepare a stupe dip the flannel in very hot water and wring it out quickly with a stupe wringer composed of a strip of muslin about eighteen inches square with a stick run through a hem at each end; any stupe which can be wrung out with the hands is not hot enough to be of much value. Stupes must be changed oftener than poultices — about once or twice an hour.

Cold is used locally to relieve pain and reduce inflammation. It may be applied in the form of compresses, the ice bag, or cold coils.

Cold compresses consist of a couple of layers of gauze dipped in ice water or laid upon ice and afterward applied to the part; they must be renewed constantly before they get warm. A large piece

of ice is placed in a basin upon a towel or piece of flannel; upon this the compresses, first soaked in water are placed; as a fresh one is taken the old one is put back upon the ice (Fig. 89).

The *ice bag* is filled about half full of finely crushed ice mixed with a little salt, and care taken to expel the air before it is closed. A layer of dry lint or cotton is placed between the bag and the skin to prevent pain or even frost-bite. Care must be taken to refill the bag before all the ice melts; nothing is more common than to see neglect of this necessary rule. To crush the ice conveniently a stout canvas bag and mallet should always be at hand.

Ice-water coils are made of rubber tubing sewed upon a piece of rubber sheeting of such size and shape as to fit the part to be kept cool; several feet of tubing are left free at each end to act as a siphon; one end is placed in a pail of ice water above the patient's head and the other in a basin on the floor, and the siphon started.

Lotions are medicated solutions used externally. Evaporating lotions are applied on a single layer or two layers of gauze and left exposed to the air. With other lotions several layers are used and covered with a protective.

Counter-irritants are substances used to produce irritation of the skin in order to relieve pain, congestion, or inflammation in a part beneath or even at a distance; they accomplish this by dilating the superficial blood-vessels, and at the same time by reflex action causing a contraction of the deeper ones, thus drawing the blood away from the affected part. Counter-irritants are classified as: *rubefacients,* those causing only redness of the skin; *vesicants,* those producing blisters; and the *cautery.*

Mustard, turpentine, iodine, liniments, and cups are rubefacients. Mustard is used in the form of foot bath, poultice, plaster, and leaves. The first two have already been described. A *mustard plaster* is prepared by mixing one part of mustard with one to five parts of flour according to the strength desired; sufficient tepid water is slowly added to make a smooth paste, which is then evenly spread on paper or muslin and covered with a layer of gauze or tissue paper. The plaster is applied to the part and held in place by a bandage or adhesive-plaster strips. Hot water or vinegar should never be employed in making a mustard plaster, as either causes the evaporation of the volatile oil of mustard. The plaster should be left on for twenty minutes or a half-hour, the purpose being to produce redness

of the skin. In old persons and children the effect should be closely watched to prevent blistering. After removal, any adherent particles of mustard should be wiped away and the surface dusted with starch or oiled with vaseline.

Mustard leaves are ready prepared and require only to be dipped in tepid water before use; the objection to them is that they have usually lost their strength.

Turpentine is used in the form of stupes above described.

Iodine in the form of tincture is painted on the part, one or two coats, with a camel's-hair brush. Where the skin is thin and moist as in the groin or in young children, it may blister. When the burning caused by it is excessive it may be stopped by washing off the iodine with alcohol. The stain may be removed by washing with ammonia or thiosulphate of soda.

The various stimulating *liniments* have some value as counter-irritants, though they are chiefly useful by virtue of the massage by which they are applied.

Dry cups act not only as a counter-irritant but they also leave an actual extravasation of blood beneath the skin; they cannot be applied over bony or irregular surfaces. The number is usually designated, from a dozen to a hundred; half a dozen or more may be in place at a time and they may be left on about five minutes unless they drop off sooner. To apply them we need a dozen cups or small tumblers, an alcohol lamp, a cup of alcohol, a swab, matches, and towels. The swab is prepared by wrapping tightly with cotton the end of a small stick, probe, or wire.

Dip the swab in the alcohol, light it, hold it for a moment inside the cup to exhaust the air, then quickly apply the cup to the part; repeat the motion as rapidly as possible. Be careful to avoid burning the patient by dropping burning alcohol upon him or by undue heating of the edges of the cup. To remove the cup hold it in one hand and with the index finger of the other press the skin just underneath the edge of the cup so as to admit the air, when the cup will fall off. Before reapplying the same cups they must be wiped dry inside with a towel. Wet cupping is done in the same way as dry cupping only the skin is first scarified by means of a special instrument known as a scarifier.

Biers cups which have an attached rubber bulb as an exhaust

pump are used not only as a counter-irritant, but to relieve inflammation and pain by increasing the amount of blood in a part.

Vesication or *blistering* is used when we wish a more decided effect than can be obtained from rubefacients. The principal vesicant is *cantharides* in the form of plaster or collodion. Before the application of a blister the skin should be washed, and shaved if necessary; a piece of plaster of the designated size is then moistened with a little alcohol, applied to the part, and held in place by a bandage; strips of adhesive plaster are objectionable because they may exert painful pressure on the blister as it rises.

The cantharides is left on until a blister forms, usually eight to ten hours; at the end of that time if there is still no blister the plaster should be removed and a poultice applied; this will usually raise the blister promptly. The cantharidal collodion is used by painting on a couple of coats and covering with cotton or oil silk. When a blister is required to be raised quickly it is done by soaking a piece of lint with ammonia or chloroform, applying it to the part and covering with a watch glass or cupping glass to prevent evaporation. A still more prompt effect may be obtained from the actual cautery.

After the blister is raised its management will depend upon the directions of the physician. It may be protected by a layer of cotton and left to be absorbed unbroken, or it may be punctured with a sterile needle and the fluid allowed to escape, or the whole of the raised cuticle may be cut away and the raw surface dressed.

The *actual cautery* is simply a hot metal instrument applied to the skin usually at a cherry-red heat; it is used to relieve pain, cause the absorption of effusion, and to control bleeding. The form used in the army is the *Paquelin cautery*, an instrument in which the platinum tips, first heated in an alcohol flame, are maintained incandescent by pumping into them the vapor of benzine; it is a valuable appliance, but requires care in handling, as it readily gets out of order. The benzine is poured into the reservoir until the lint or sponge which it contains is just saturated; any free liquid might get into the tube and cause an explosion.

Care must be used not to let anything touch the tip while it is hot.

Among the caustics in common use are nitrate of silver (lunar caustic), sulphate of copper (blue stone), and nitric acid

Lunar caustic is kept in a caustic holder; it should be cleaned

before use with a piece of moist cotton, and dried after use; it should not be allowed to touch the hands or linen, because it makes a black stain. To give a point to a stick of lunar caustic rub it on wet lint; never attempt to scrape it.

Blue stone is used especially for touching granulated lids; the crystal should be ground to a point on a fine stone.

Nitric acid is used for burning (disinfecting) chancroids. Dry the ulcer and drop on it a few drops of four-per-cent solution of cocaine; after a minute or two dry again, dip the wood end of a match in the nitric acid and touch thoroughly every point of the sore; then pour cold water over the part.

CHAPTER VII

TEMPERATURE, PULSE, AND RESPIRATION

THE *normal temperature* of the human body is about 98.6° F. (37° C.), but the normal varies within certain limits according to the part of the body in which the temperature is taken, and according to the time of day. The temperature is ordinarily taken in the mouth, in the axilla, or in the rectum; the axillary temperature is about one-fourth of a degree lower than that taken in the mouth, while the rectal temperature is a fourth to a half a degree higher. The highest temperature is usually recorded about four o'clock in the afternoon and the lowest about two o'clock in the morning; the difference may be as much as a degree. A variation of temperature below 97.5° F. or above 99° F. may be regarded as abnormal and an indication of disease.

Abnormal temperature may be subnormal or elevated.

Subnormal temperatures are produced by anything which causes a general depression of the vital powers. Shock, hemorrhage, heat exhaustion, exhausting disease, may all cause subnormal temperature; when the depression of temperature is below 96° F. the condition is one of *collapse*.

Elevation of temperature, or *fever*, means either that more heat is being produced than usual or that it is not being gotten rid of promptly; usually both conditions are present. You will remember that the evaporation of perspiration is one of the most important provisions of nature for regulating temperature, and as a matter of fact in fever the skin will usually be found to be very dry. A fever of 100–103° F. is regarded as *moderate;* 103–105° F. as *high fever*, while temperatures above 105° F. are denominated *hyperpyrexia*.

A depression of temperature of several degrees is usually of much more importance than a corresponding elevation; thus a depression of three and a half degrees would give a temperature of 95° F., or the temperature of collapse, a condition which means speedy death

unless prompt reaction takes place. On the other hand an elevation of three and a half degrees would only give 102° F., a temperature by no means alarming. Hyperpyrexia, however, temperatures 106° to 109° F., is very dangerous, although recovery has often followed prompt remedial measures.

The instrument for measuring the temperature of the body is called a *clinical or self-registering thermometer.* The self-registering feature is secured by a break in the mercurial column corresponding to a constriction in the glass. When the mercury column has risen above the normal line, which is usually indicated by an arrow, it must be shaken down by a sweeping motion of the arm before the thermometer is used again.

The Fahrenheit scale is usually employed in this country, but the thermometers issued to the army are generally graduated in the Centigrade scale also. The normal in the Centigrade is 37°, 40° C. corresponding to 104° F. To convert Fahrenheit degrees into Centigrade subtract 32 and multiply by $\frac{5}{9}$. For example:

$$98.6 \text{ F.} = [(98.6 - 32) \times \tfrac{5}{9}] = 37^\circ \text{ C.}$$

Conversely, to convert Centigrade to Fahrenheit multiply by $\frac{9}{5}$ and add 32; example:

$$37^\circ \text{ C.} = [(37 \times \tfrac{9}{5}) + 32] = 98.6^\circ \text{ F.}$$

When in doubt about a thermometer compare it with one of known accuracy by simultaneous observations on the same patient.

Temperatures are ordinarily taken in the mouth, the bulb being placed under the tongue and the patient directed to close his lips, but not his teeth upon it. If the patient is very weak it may be necessary for the nurse to hold the thermometer in his mouth. With modern thermometers three minutes is ample for mouth temperatures. When the patient is delirious or unconscious, or is a child, it is not safe to take the temperature in the mouth.

In infants and children the temperature is usually taken in the rectum; the bulb well oiled is introduced for about an inch and a half; one or two minutes' time is sufficient.

To take a temperature in the axilla, the arm pit is first wiped dry, the bulb put in place and the arm carried across the chest so as to bring the opposing skin surfaces in close contact with the thermometer; a little longer time is required than in the mouth or rectum — about fixe minutes usually.

Thermometers when not in use should be kept in an antiseptic

solution and resting on a bed of cotton; bichloride of mercury is objectionable for this purpose as it soon removes the markings on the glass. Before using for another patient the thermometer should be rinsed in clean water and wiped dry.

Fevers are classified as *continued, remittent, or intermittent. A continued fever* is one in which the temperature is continually above normal, and there is a difference of not more than about one degree between morning and evening; typhoid fever in the second week is usually a continued fever. *In remittent fever* there is a decided drop some time in the twenty-four hours, but the temperature does not reach normal. *In the intermittent fevers* the temperature at certain intervals falls to or below the normal; malarial fevers are apt to be remittent or intermittent.

In keeping a record of fevers *charts or thermographs* are employed. Temperatures are usually recorded morning and evening, but in typhoid fever and other serious fevers this is generally done every three hours or oftener. In marking charts a dot is placed on the point at which the temperature stands, and these dots are connected by straight lines drawn with the aid of a ruler.

The *normal pulse rate* in the adult is about seventy-two to the minute; it varies, however, from about sixty-five to seventy-five. In children it is much more rapid. In fevers it rises considerably.

The condition of the pulse is very important, as it usually accurately indicates the condition of the heart and vital powers.

The pulse may be taken by laying the fingers gently on any superficial artery, but usually the radial artery is the most convenient; the temporal is also frequently used for the purpose. The points to be noted are *frequency, regularity, intermittence, fullness, tension* and *strength*. Frequency of the pulse is increased by exercise, food, excitement, and position; the pulse is more frequent in the standing position than when lying down or sitting.

An *irritable pulse* is one which is easily excited; an *intermittent pulse* is one which drops a beat now and then; a *dicrotic pulse* occurs in extreme weakness, as in typhoid fever, and consists of two waves to each beat so that the rate may appear twice as fast as the actual pulsations of the heart.

The normal respirations occur at the rate of about eighteen to the minute. In disease there occur marked variations in the frequency and character of the respirations; in narcotic poisonings the respira-

tions are very slow, while in penumonia and peritonitis they are very rapid.

In taking respirations one should notice their *frequency* and *regularity*, whether *difficult* or *easy*, *noisy* or *quiet*, *deep* or *shallow* and whether *symmetrical*, that is to say the same on the two sides of the chest.

Cheyne-Stokes respiration is that peculiar type of breathing which occurs in certain diseases of the heart and kidneys. The respirations gradually increase in frequency and intensity up to a certain point, then slowly decrease until they seem to entirely cease; after a short pause the same course is gone through with again.

In *stertorous breathing* there is a loud snoring noise with inspiration.

Dyspnea means difficult or painful breathing.

In taking respirations it must be remembered that they are in a measure under the control of the will; therefore, they must be taken without the patient's knowledge, and this is done by laying the arm across the chest in taking the pulse, and then without removing the fingers from the wrist taking the respiration while appearing to take the pulse. With a little practice a nurse should become so expert that he can take the pulse and respiration of a sleeping patient without arousing him.

In the normal condition, the pulse, temperature, and respiration rates have a definite relation to each other, and the three factors should always be considered together in disease, as disturbance in the normal ratio may have the most important meaning.

In health the pulse rate is about four times the respiration rate; when the respiration rate is increased to a third or a half of the pulse rate it is usually an indication of disease of the lungs such as pneumonia. In fevers, when the temperature rises the pulse becomes proportionally more rapid; if instead of rising with the temperature the pulse slowly falls, an important sign of yellow fever is present; if on the other hand the pulse rate becomes more rapid than that which is usual with a given temperature, it is an indication of weakness and diminished vital powers.

CHAPTER VIII

SYMPTOMS AND CLINICAL RECORD

ONE of the most important duties of a nurse is to cultivate the habit of observing symptoms accurately and reporting them clearly and intelligently.

The physician can only be with the patient a short time, and he must depend upon his nurse to inform him of everything that takes place in his absence; the nurse may thus obtain information of the greatest value in diagnosis and treatment. *Symptoms* may be divided into two classes: *subjective symptoms,* those which are only apparent to the patient himself, such as pain; and *objective symptoms,* those which are apparent to others, such as redness and swelling. Sometimes the symptoms are *feigned,* when the patient is said to be *malingering;* it is always safer to assume, however, that the symptoms are real until the contrary is proved.

Not only must the nurse cultivate the habit of observing symptoms, but he must learn how to attach to them their relative importance. Emergencies continually arise when he must determine what is to be done; are the symptoms of sufficient gravity to cause him to call in the noncommissioned officer or send for the surgeon? Shall he loosen a bandage or give a stimulant on his own responsibility?

The observations should commence with the giving of the first bath or putting the patient to bed. Are there any scars, wounds, or eruptions upon the body? Is the patient emaciated or dropsical? Does he appear weak and ill? The *attitude and expression* are sometimes characteristic. In inflammation of one lung the patient usually lies on that side so as to give free play to the uninjured lung. In appendicitis or peritonitis he is apt to lie on the back with one or both legs drawn up.

Slipping down toward the foot of the bed means weakness and is therefore unfavorable.

With colic the patient often lies on the abdomen with a pillow pressed against it; but when the pain is inflammatory he can not stand the pressure.

When the patient can not breathe while lying down there is usually trouble with the heart or lungs.

Great restlessness is often a bad sign.

An anxious look is unfavorable, while a tranquil expression is of the opposite import.

The pallor and pinched expression of seosis are characteristic, but can not well be described.

Rattling in the chest, with shortness of breath and a bluish tint of the lips, is a sign of edema of the lungs and often indicates approaching death.

The *mental condition* gives important indications: whether the patient is conscious or unconscious; rational or irrational; depressed or excited or muttering. The speech may be thick or clear or hoarse.

The *eyes* are to be observed; whether the pupils are dilated or contracted or unequal; whether there is any squinting; any yellowness or congestion of the conjunctiva.

The *hearing* may be painfully acute or it may be defective; there may be a discharge from the ear.

Bad taste may be complained of or offensive odors.

The *skin*, especially of the face, may give important indications; it may be pale, flushed, livid, or jaundiced; hot, cold, dry, or moist. A moist skin with high temperature is usually a bad omen. A peculiar red spot high up on either cheek is often indicative of pneumonia or consumption; pallor about the lips is a sign of nausea. Then we have the waxy hue of Bright's disease and the rashes of the eruptive fevers; the sallow color of narcotic users, the pallor of anaemia, the blue tint of cyanosis, the bronzing of Addison's disease. Bluish spots about the size of a finger nail distributed about the trunk are a sure sign of body vermin.

The *tongue* offers many valuable indications; note whether it is dry or moist, clean or coated, large or small, bitten, or indented on the edges by the teeth. In malarial fevers and digestive disorders the tongue is apt to be heavily coated and indented by the teeth; in typhoid fever it is at first moist and coated, but soon becomes dry and cracked; when such a tongue becomes moist and begins to clean up from the edges it is a very favorable sign. In scarlet fever the bright-red papillæ showing through the white fur produce the characteristic *strawberry tongue*. In yellow fever the tongue is small, red, and pointed.

Note at the same time the *condition of the mouth and teeth;* white slightly raised patches on the inside of the lips and cheeks, at the corners of the mouth, and in the throat are frequently mucous patches, a sign of syphilis. The dark accumulations which occur on the teeth in fevers are known as *sordes;* their presence indicates that the mouth has not been well cared for.

The *odor of the breath* is often significant; sweet in diabetes, urinous in uraemia, fetid in disorders of the stomach, gangrene of the lungs, bad teeth, etc.

The state of the *appetite* is of importance; it is usually lost in acute diseases, but occasionally is excessive. Observe with care how much food the patient actually takes. Nausea is often present with or without vomiting. The frequency of the *vomiting,* whether it is painful, and the character of the matter vomited should be noted. Usually the vomitus consists of food at first, but this may be followed by bile, mucus, or blood. When blood has been retained in the stomach some time it becomes brownish in color, like coffee grounds; vomitus of this character is seen in yellow fever. Vomiting of fecal matter is a sign of great importance and indicates obstruction of the bowels. Great thirst is usually an indication of fever or hemorrhage.

The number and character of the *stools* should be noted. Blood, unless fresh, gives the stools a black, tarry appearance; in jaundice they are generally clay-colored; bismuth and iron color them black; they may be liquid or solid, and may contain mucus, pus, blood, or worms.

Tenesmus, a constant desire to evacuate the bowels, is present in dysentery.

Belching of gas, rumblings in the bowels, and distention of the abdomen are signs to be noted.

The *urinary functions* should be carefully noted, and in special cases the amount passed carefully measured. In both *suppression and retention* no urine is passed, but in the former, which is much the more serious condition, no urine is secreted; it may be distinguished from retention, which is caused by some obstacle to the escape of urine from the bladder, by the fact that in suppression the bladder may be shown to be empty by tapping with the finger just above the pubis; a hollow sound is produced if there is no urine in the bladder.

Incontinence of urine, that is, the inability to hold it, may be associated with retention, so that the mere fact of constant dribbling does not preclude the possibility of the bladder being distended.

The quantity of urine should be measured and the frequency with which it is passed noted. Useful information may also be obtained from observation of its color and odor. Blood gives it a smoky or red hue, pus a milky appearance, and mucus a stringy condition. Bile imparts a greenish tinge, as does carbolic acid, while santonin gives a bright-yellow color. Many drugs and vegetables impart a characteristic odor to urine.

Cough is an indication of some irritation of the air passages; the matters coughed up are called *sputa.* When there is no sputum the cough is said to be dry. The cough may be tight, loose, or painful; then there is the hoarse, crowing cough of croup or diphtheria, the spasmodic whoop of whooping cough, the wheezing cough of asthma, the painful cough of pleurisy, and the peculiar rasping cough of aortic aneurism. The character of the sputum varies; in *bronchitis* it is white or yellow and mucous; in *pneumonia* it is reddish and very sticky; in *tuberculosis* it is at first mucous and frothy, later it is purulent with cheesy nodules, and sometimes stained with blood.

In gangrene of the lung the sputum is unbearably offensive.

Hiccough when it is persistent in the later stages of acute diseases is often a very grave sign.

When a patient complains of feeling cold take his temperature; a chill is nearly always accompanied by fever. *Chills* frequently accompany the onset of acute disease; when they occur *in the course of inflammation* they often indicate suppuration; *in malaria,* while severe, they are not usually dangerous.

Hemorrhage from any part of the body is always significant; nose-bleed is often one of the early signs of typhoid fever.

Pain is one of the most valuable signs which we possess, as it often points toward the location of the disease. The kind of pain should be described and whether it is constant or intermittent, severe or slight. Exaggerated sensitiveness to touch is called *hyperesthesia* and diminished sensibility *anesthesia;* the latter is often associated with loss of muscular power or *paralysis;* paralysis of the lower half of the body is called *paraplegia;* of a lateral half *hemiplegia.*

Disorders of motion include picking at the bedclothes, always

a bad sign, twitching of the tendons (*subsultus*), slight spasms, and local or general convulsions. In convulsions always note the parts affected and whether the attack is attended with loss of consciousness.

Under *disorders of consciousness* are included *delusions* and *hallucinations, delirium, stupor, and coma.*

The character of the delusions should be noted, whether occasional or habitual, quiet or noisy; in stupor note whether the patient can be aroused; if he can not, it is coma, a very serious condition. *Coma vigil* is a combination of sleeplessness with partial unconsciousness and is also a symptom of bad omen.

The amount and character of *sleep* should be recorded; patients' statements on this point must be accepted with caution.

That nothing concerning the patient's condition may be forgotten, *clinical records* are kept. The blank forms for this purpose are of a uniform size, 3½" by 8", perforated at the top so that on the completion of the case the various sheets pertaining to it may be assembled and filed together.

Collection of specimens. It is usually necessary to keep specimens of urine, feces, sputum or vomitus, for the inspection of the visiting physician. Ordinarily these are best kept in the vessel in which they are received. It should be placed in a cool place and protected from dust.

If sterile specimens are needed, the vessel in which they are received to be kept, should be sterilized by boiling or otherwise.

If specimens of urine are to be kept for any length of time, it may be necessary to add a few drops of formalin or chloroform to them, to prevent decomposition.

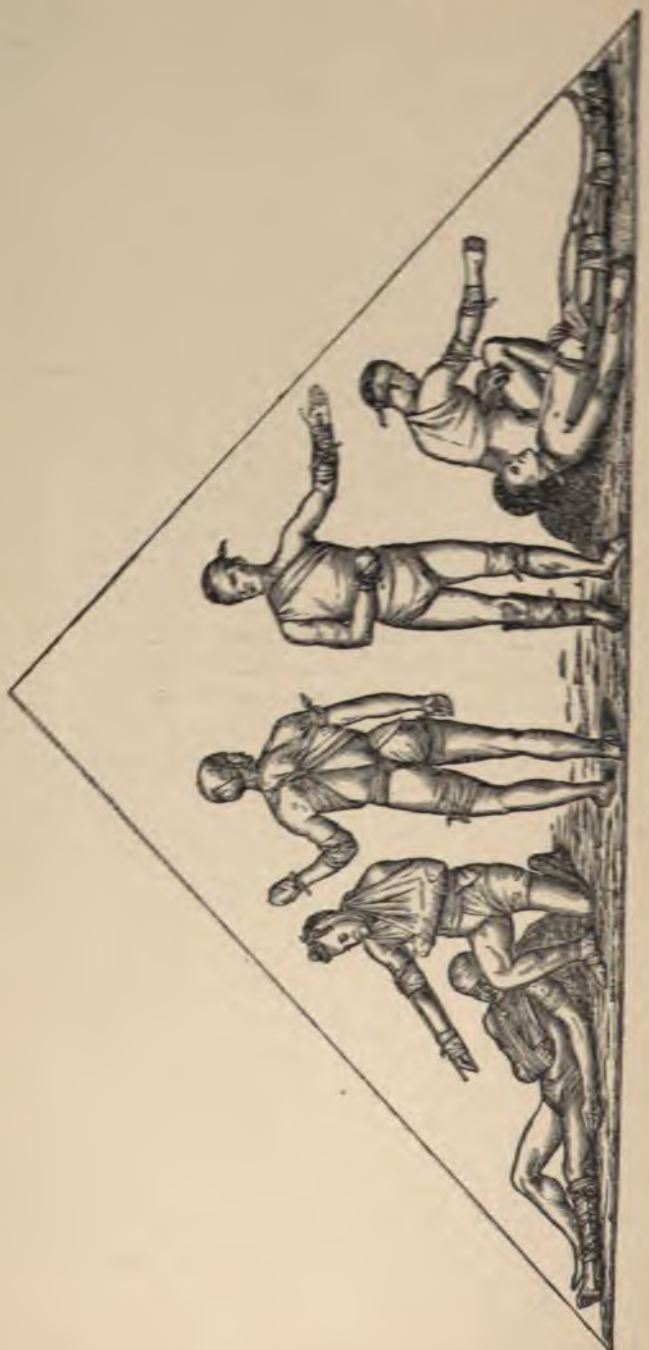

Fig. 90.—Triangular Bandage.

CHAPTER IX

BANDAGING

BANDAGING must be taught practically, one-half of the class practicing on the other half. Three general types of bandages are used in the army; triangular, roller, and tailed bandages.

The triangular bandage possesses special advantages for the military service in that it is quickly and easily applied and removed.

FIG. 91.—Reef Knot.

The triangles are made by taking a piece of cheese cloth 38 to 41 inches square and cutting it diagonally into halves (Fig. 90).

The bandage is used in three general forms: as an open triangle, folded twice from apex to base as a *broad cravat,* and folded three times as a *narrow cravat.*

To fasten the ends together the reef knot (Fig. 91) is used, which is much more secure than the "granny" (Fig. 92).

FIG. 92.—"Granny" Knot.

Applications of the triangular bandage. Head: Place the base of the triangle just above the eyes and let the apex hang down over the occiput; cross the ends below the occiput, bring them to the front and tie (Fig. 93); bring the apex up over the crossed ends and pin (Fig. 94).

Eye: Use the narrow cravat, tying the ends behind (Fig. 95).

Chin or side of head or face: Use the narrow cravat, tying under the chin or on top of the head. Or apply middle of handkerchief over front of chin and tie back of neck (Fig. 96).

Neck: Use broad or narrow cravat. Place center of cravat over dressing, cross on opposite side and tie in front (Fig. 97).

Chest: Apply the center of the open triangle over the dressing;

tie the ends on the opposite side, leaving one end long; bring the apex over the shoulder and fasten to the long end. If the end is not long enough lengthen it by using a narrow cravat (Figs. 98 and 99). *Pelvis:* Apply the center of the base of the opened triangle just below the navel; carry the ends around to the back and tie one

FIG. 93.— Triangle or the Head; front.

FIG. 94.— Triangle of the Head; rear.

FIG. 95.— Narrow Cravat of One Eye.

end long; bring the apex over the perineum and between the legs to the rear and fasten to the long end (Fig. 100).

Buttocks: Apply the base of the opened triangle to the lower part of the back; bring the ends around the sides, crossing them in front, and pin; split the apex and fasten in front (Fig. 101).

Slings: The large arm sling is applied in three different ways.

FIG. 96.— Narrow Cravat of Chin and Face.

FIG. 97.— Narrow Cravat of Neck.

In the *first method* place one end of the triangle over the sound shoulder; the base should be in front and the apex in rear; bring up the front end over the shoulder of the injured side and tie on the side of the neck; bring the apex forward and pin (Fig. 102). When the collar bone is injured the *second form* is used; it is applied in the same manner as the first except that the front end is carried under the arm pit instead of over the shoulder of the injured side

(Fig. 103). *In the third form* the rear end is carried over the shoulder of the injured side; otherwise it is the same as the second (Fig. 104). For the small sling the narrow cravat is used, carried over the shoulders and fastened behind (Fig. 105).

FIG. 98.— Triangle of the Chest; front view.

Shoulder: Place the apex of the triangle on the shoulder; carry the ends around the arm, crossing them and tying at the outside; fold the apex over a sling or neck cravat and pin (Fig. 105).

Elbow: Use a broad cravat as shown in Fig. 105, or a large arm sling (Fig. 102).

Hand: Place the hand, palm up, on the triangle, ends of the fingers toward the apex; bring the apex up over the palm; pass the ends around the wrist over the apex, which is then folded toward the fingers and covered by another turn of the ends; tie the ends behind (Fig. 105).

FIG. 99.— Triangle of the Chest; rear view.

Hip: Apply a narrow cravat around the waist. Carry the ends of the triangle, base down, around the thigh and fasten. Pass the apex under the cravat, fold over and tie (Fig. 106).

Knee: Use the broad cravat; cross behind and knot in front below the knee-cap; or *vice versa* (Fig. 107).

Foot: Place the foot on the triangle, toes toward the apex; bring

the apex up over the toes toward the ankle; cross the ends over the front of the ankle and over the apex of the bandage, then carry them back around the ankle, crossing them behind in such a manner as to catch the base of the triangle; next draw up the apex so as to tighten the bandage and fold it over toward the toes. Bring the ends forward and, crossing over the ankle and apex, carry them beneath the foot and tie on the inside (Fig. 108).

Fig. 100.— Triangle of the Pelvis.

To fasten splints: Take a narrow cravat, double it upon itself; place the loop on the outside of the limb; carry the free ends around the limb and one of them through the loop; then tighten as much as necessary and tie (Fig. 64).

Roller bandages consist of strips of cloth of variable length and width. To apply them properly requires care, time, and constant practice; hence they have considerable less value for first-aid purposes than has the triangular bandage.

The chief materials from which rollers are made are muslin, cheese cloth, gauze, flannel, and rubber; each has its own special qualities.

The most general and useful sizes are as follows:

For the head, 2 inches wide and 5 yards long.

For the upper limb, 2½ inches wide and 5 to 10 yards long.

Fig. 101.— Triangle of the Buttocks.

For the trunk, 4 inches wide and 5 to 10 yards long.

For the lower limb, 3 inches wide and 5 to 10 yards long.

For the fingers, ¾ of an inch wide and 1 to 2 yards long.

Roller bandages should be torn, not cut. To prepare a number at one time take a piece of muslin of the required length, tear off the selvage, with the scissors split one end into the required widths, tear down for a couple of feet, separate the alternate strips, hand one set to one person and the other to another. Each now pulls firmly until the piece of cloth is torn through the entire length.

FIG. 102.— Large Sling No. 1.

Besides a machine for rolling bandages there are two methods of rolling by hand. Take a couple of feet of the end of the bandage and fold repeatedly upon itself until a firm mass is formed; then sitting in a chair cover the right leg, foot, and adjacent floor with a clean towel or sheet, place the small roll on the thigh, the loose part of the bandage extending down over the knee to the floor, and roll toward the knee; when the roll reaches the knee draw it up to the groin and then repeat the motions (Fig. 109).

FIG. 103.— Large Sling No. 2.

After a firm roll is made in this manner it may be finished by hand if desired; in this method the bandage is grasped as shown in Fig. 110 and rolled by alternate movements of pronation and supination of each hand.

Rules for bandaging: 1. Place the limb in the position it is to occupy. If the arm is bandaged in the straight position and then bent, the bandage will cut in at the bend of the elbow and stop the circulation.

2. Begin at the extremity of the limb, the ends of the fingers for the upper extremity, the tips of the toes for the lower; if this rule is not followed, the parts below the bandage will swell.

3. Place a layer of cotton between opposed skin surfaces, such as the fingers and toes.

4. Hold the roller in the right hand when bandaging the left limb, and *vice versa.*

5. Place the outer surface of the bandage on the inner side of the extremity and secure by making a couple of circular turns.

FIG. 104.— Large Sling No. 3.

FIG. 105.— Small Sling, Triangles of the Hand, Elbow, and Shoulder.

6. Bandage evenly and neither too tight nor too loose. Leave the tip of the extremities exposed to observe the state of the circulation in the part. If the blood when pressed out of the nails does not promptly return, the bandage is too tight and may cause gangrene.

Roller bandages may be applied by *circular turns, simple spirals, reversed spirals, figure-of-8, spica,* and *knotted turns.*

Circular turns and *rapid spirals* are used chiefly to hold dressings in place; the method of using them is clearly shown in Fig. 111. The *slow spiral* (Fig. 112) is used where a limb is nearly cylindrical in

shape; each turn is parallel with the turn below, which it envelops for about one-third of its width. For a limb increasing in size like the leg or forearm this bandage would not lie evenly, and it becomes necessary to resort to reverses.

The method of making *the reverse* is shown in Fig. 113; the bandage should be held loosely to give slack; the reverses should be in line and on the outside of the limb.

For covering the joints *the figure-of-8* bandage becomes necessary; as the name implies, figures-of-8 are made in alternate loops above and below the joint; each loop covering in one-third of that immediately below (Fig. 114).

The *spica* is really a figure-of-8 with one loop much larger than the other, and is used especially at the hip and shoulder (Fig. 114).

Fig. 106.—Triangle of the Hip.

The *knotted turn* is used where it is desired to make pressure, especially on the temple. Unroll about a foot of the bandage and hold it against the temple; then carry the roll around the forehead and occiput; on reaching the starting point, twist the roller around to a right angle and carry it down under the chin and over the vertex; then fasten the ends (Fig. 53).

Fig. 107.—Broad Cravat of the Knee.

Special applications of the roller bandage:

Recurrent of the head: Make a couple of circular turns about the forehead and occiput; reverse in front and carry the roller back to the occiput over the middle of the vertex; reverse again and bring for-

ward, covering in one-third of the preceding turn, continuing to carry the roller backward and forward until the head is well covered, when all the reverses are held in place by circular turns and pins or sewing. Until the circular turns are made all the reverses must be held in place by an assistant (Fig. 115).

FIG. 108.— Triangle of the Foot.

Recurrent of a stump: Made in the same manner as the recurrent of the head (Fig. 116).

Figure-of-8 of the eye: Place the end of the roller on the temple and make a couple of circular turns around the forehead and occiput, from right to left for the right eye, and *vice versa* for the left. Reaching the occiput, pass from under the right ear up over the right eye, across the opposite temple and down again to the occiput; make as many of these turns as necessary, and finally fix by circular turns (Fig. 117).

Figure-of-8 of the jaw (Barton's bandage): Place the end of the roller below the occiput; pass obliquely up over the right parietal bone, across the vertex, down over the left temple in front of the ear, under the chin, up over the right temple in front of the ear, across the vertex, and back to the starting point. Then pass forward along the right side of the jaw in front of the chin and back along the left side of the jaw to the starting point. These turns may be repeated as often as necessary (Fig. 118).

FIG. 109.— Rolling Bandage on the Knee.

Spiral of the chest: Unroll about five feet of the bandage; let the free end drop down over the front of the chest to about the knees of

the patient, carry the roller over the opposite shoulder to the base of the chest, then around the chest over the loose end, ascending by a slow spiral. When the chest is bandaged as high as necessary fasten the last turn by a pin. Then bring up the loose end of the bandage over the other shoulder and down the back to the base of the chest and fasten to the lower and upper turns; this prevents the bandage from slipping down.

FIG. 110.— Rolling Bandage by Hand.

Velpeau (for fractured clavicle): Place the palm of the hand of the injured side on the sound shoulder, with padding between the arm and chest wall. Place the initial end of a roller in the axilla of the sound

FIG. 111.— Rapid Spiral.

FIG. 112.— Slow Spiral.

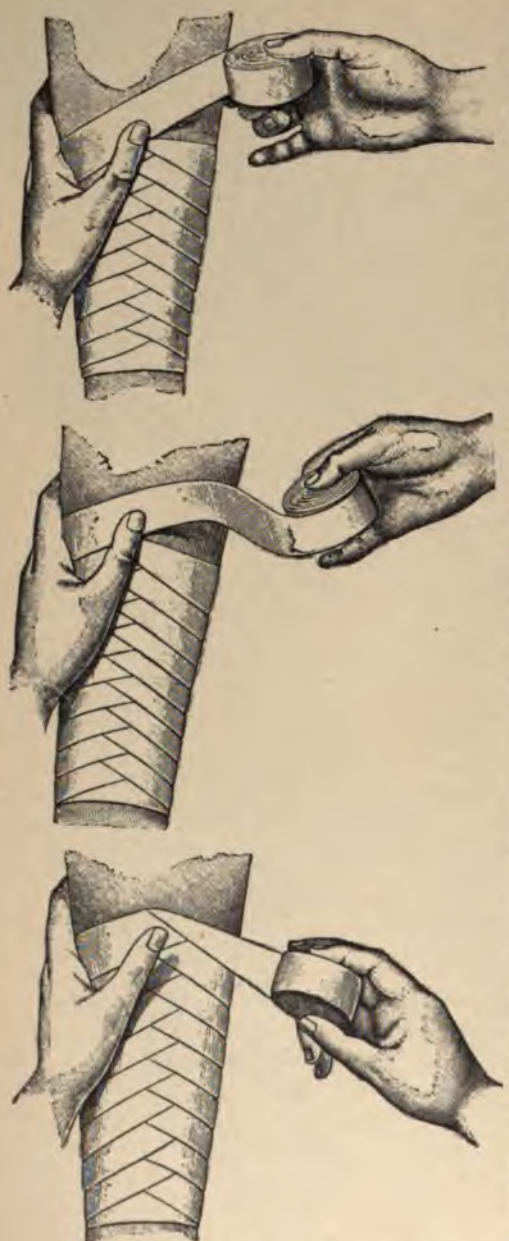

FIG. 113.—Steps in Making Spiral Reverses.

side, carry the bandage up across the back, over the shoulder of the injured side, down the *outside* of the arm, under the *outside* of the elbow, and across the front of the chest to the starting point; repeat this turn, but when the sound axilla is reached the second time make a circular turn around the chest and over the arm; then repeat the first and third turns alternately, each layer of bandage covering in about two-thirds of its predecessor. Stitch or pin the points of intersection of the turns (Fig. 119).

Scudder's modification of Velpeau: Commence in the axilla of the sound side as in the ordinary Velpeau, but carry the first and second turns horizontally around the front of the chest, the first under and the second over the elbow. The third turn ascends over the front of the chest to and over the injured shoulder, down the back of the arm, under the elbow and up again over the same

FIG. 114.— Figure-of-8, or Spica of the Shoulder. FIG. 115.— Recurrent of the Head.

FIG. 116.— Recurrent of a Stump.

FIG. 117.— Figure-of-8 of One Eye. FIG. 118. —Figure-of-8 of the Jaw (Barton's Bandage).

shoulder, thence across the back to the opposite axilla, and again horizontally around the chest, covering in one-third of the previous horizontal turn. These movements are repeated until the shoulder is reached (Fig. 120).

Finger bandage: Make two turns about the wrist, pass diagonally over the back of the hand to the root of the finger, descend by spiral turns to the tip, make a circular turn, then ascend by slow spirals

FIG. 119.— Velpeau of the Shoulder.

or reverses; on again reaching the base of the finger cross the back of the hand to the wrist and finish with a circular turn about the latter (Fig. 121).

Foot bandage: Make a couple of circular turns around the ankle; descend obliquely over the dorsum, under the sole, and back to the dorsum of the foot, up which the bandage must pass by several spiral turns, covering the instep; when this is reached, pass the

bandage under the paint of the heel, thence to the dorsum, then down beneath the sole, then along the outer surface of the heel, next around the heel above its point to reach the instep, whence,

FIG. 120.— Modified Velpeau.

passing to the sole, a turn is made around and above the point of the heel on the inner side, again to pass the instep, when the roller must be carried by spiral and reversed turns up to the knee (Fig. 122).

FIG. 121.— Finger Bandage.

Tailed bandages: Bandages of various widths split at each end are called 4-tailed and are very useful about the head. The methods of their application are shown in Figs. 123 and 124.

The T-bandage is especially useful in confining dressings to the perineum and pubic region; it is made by sewing a strip of bandage to the middle of another strip, the two forming a right angle.

Gauze bandages, sterilized, are usually employed in aseptic dressings.

FIG. 122.— Foot Bandage.

Flannel bandages are used when it is desired to produce a moderate degree of elastic pressure, or where warmth is necessary. They lie more smoothly than non-elastic materials.

Rubber bandages are of special value when considerable pressure and support are necessary. They must be used with care and frequently adjusted and washed with soap and water. They are also

FIG. 123.—Four-Tail Bandage for the Vortex.

FIG. 124.—Four-Tail Bandage for the Occiput.

employed like a tourniquet to control bleeding and may be very quickly and effectually applied as follows: Make several circular turns about the limb above the bleeding artery, then lift up one of the turns and pass the unrolled part of the bandage under the turn and over the artery (Fig. 44).

Crinoline is used for fixed bandages, especially the *plaster-of-paris bandage;* gauze may also be used for this purpose, but a stiffer

material is better. The bandages are prepared by placing on a paper a lot of freshly opened plaster and rubbing it into the meshes of the material with the hand while the bandage is being loosely rolled. When the bandages are not required for immediate use they should be wrapped separately in waxed paper and kept in a warm, dry place, preferably in tins. To apply, first cover the part with a flannel bandage or other protective, then place a plaster bandage, end down, in water sufficient to cover it; when bubbles cease to escape, squeeze the bandage gently and apply like any other bandage. Each time a bandage is taken out of the water place another in so as to have one always ready. Usually several thicknesses of bandage are required, especially over the joints; when necessary the dressing may also be stiffened by strips of tin incorporated in the bandage.

The floor should be protected by sheets or newspapers and the clothing of the patient and operator by the use of sheets.

The limb must be shaved, washed, dried, and powdered before the application of the bandage.

To remove plaster from the hands after completion of the operation, sugar or carbonate of soda should be added to the water, or, better, rubbed on the hands.

To remove plaster dressings when they are no longer necessary is an operation requiring patience and care. If the dressing is thin plaster shears can be used, but if it is thick a strong knife or saw is necessary. The track of the knife or saw may be softened somewhat by dropping into it a little strong acetic acid or hydrochloric acid. The operation of removal is much facilitated if a strip of tin has been placed under the plaster, in the line of incision, while it was being applied; the strip may be cut down upon without fear of wounding the patient.

CHAPTER X

INFECTION AND DISINFECTION

Bacteria are the minute vegetable organisms, so small that they can not be seen except with a microscope, many of which grow on or in the human body and cause disease. The terms *microbes* and *germs* are ordinarily used in the same sense as bacteria.

An *infectious disease* is one which is capable of infecting other persons, causing the same disease in them; smallpox and malarial fever are both infectious. A *contagious disease* is that form of infectious disease which is spread to others by *contact* with the person infected. Smallpox is a contagious disease. Malarial fever is not a *contagious* disease because no amount of simple contact with an infected person can produce the disease, the infection of which must be carried by a mosquito. *Disinfection* is the process of destroying the infectious germ or agent to prevent the spread of the disease.

An infectious disease may be due to an animal or a vegetable organism; in either case the parasite is so small as to be visible only under the microscope or not visible at all.

Some of the diseases due to animal parasites are malaria, sleeping sickness, amoebic dysentery, and probably yellow fever and dengue.

Sepsis or putrefaction is a particular form of infection; *antiseptics* are those substances which prevent putrefaction either by destroying the germs or preventing their growth.

Sterilization is the process of killing disease germs; it has the same meaning as disinfection, but is usually limited to disinfection by heat.

In all disinfection work it should be constantly borne in mind that *the agent employed must be used at the proper strength, for a definite length of time, and must be brought thoroughly in contact with all parts of the substance to be disinfected.*

The *disinfectants* commonly used by the medical department in addition to direct sunlight, are dry heat, boiling water, steam, cor-

rosive sublimate, phenol, cresol, iodine, quicklime, chlorinated lime, formaldehyde solution, and sulphur.

Dry heat is seldom used, as the high temperature necessary injures fabrics, and the heat has little penetrating power.

Flowing steam is used especially in the operating room for disinfecting dressings.

Boiling is a simple and effective method of disinfection for metallic or earthen utensils, and for cotton or linen fabrics. Woolen and leather substances are injured by steam or boiling water. The addition of one per cent of carbonate of soda increases the disinfecting power of the boiling water and prevents instruments from rusting. Actual boiling for ten minutes is ordinarily sufficient.

Corrosive sublimate in acid solution (0.2 per cent hydrochloric acid) is one of the most effective chemical disinfectants; for this purpose solutions of corrosive sublimate 1:1000 are usually employed. Its disadvantages are that it is decomposed by albuminous matters, and by hard waters, and that it corrodes and rapidly destroys metals. Solutions should be freshly prepared, and in soft water, such as rain water or distilled water. When only hard water is available some other disinfectant should be used.

Phenol is a valuable disinfectant in five per cent solution. It, like corrosive sublimate, coagulates albumin and thereby to some extent protects the inclosed germs from its disinfectant action.

Cresol in one per cent solution has about the same value as phenol at five per cent. Albuminous fluids do not interfere with its action.

Iodine in 3-5 per cent alcoholic solution is very valuable for disinfecting wounds, or sterilizing the skin before operation.

Quicklime is a somewhat uncertain disinfectant because of the fact that it is rapidly decomposed on exposure to the air and moisture. Milk of lime, a ten per cent solution of quicklime, is ordinarily employed. To be effective the lime must have been freshly burned and be unslaked.

Chlorinated lime is used ordinarily in four per cent solution in water. Its activity depends on the amount of chlorine it contains, and, as it is rapidly changed on exposure to the air, it should have been freshly opened and prepared in order to be effective.

Formalin is a solution of *formaldehyde gas* in water, its disinfecting powers depending on the dissolved gas. It is sometimes used in the form of a spray, but ordinarily the gas itself is employed.

The only apparatus required is a large open vessel, protected by some non-conductive material to prevent the loss of heat from within. An ordinary milk pail, set into a pulp or wooden bucket, will answer every purpose, although a special container (Fig. 125) will be found of considerable advantage. This container or generator consists of a simply constructed tin can with broad flaring top. Its full height is 15½ inches, the height from the bottom to the flaring top being about 8 inches. The lower or round section is 10 inches in diameter, while the flaring top is 17½ inches in diameter

FIG. 125.— Container for Generating Formaldehyde Gas. (Formaldehyde-potassium permanganate method.)

at its top. The container is made of good quality of bright tin, is supplied with a double bottom with ¼ inch air space between the two layers, and is entirely covered on sides and bottom with asbestos paper. The asbestos paper and double bottom serve effectively to retain the heat which is generated by the vigorous chemical reaction occurring within, and which is essential to the complete production and liberation of the gas. This special container can be made by any tinner of ordinary intelligence, and costs but a few dollars. The following preparatory steps should be taken —

(a) Have all windows and doors (except door of egress) tightly closed. Securely paste strips of paper over keyholes, over cracks,

above, beneath and at sides of windows and doors, over stove holes and all openings in walls, ceiling and floor. If opening be large, paste several thicknesses of paper over opening. Carefully stop up the fireplace if there be one. There must be no opening through which gas can escape.

(b) All articles in the room that can not be washed must be spread out on chairs or racks. Clothing, bed covers, etc., should be hung on lines stretched across the room. Mattresses should be opened and set on edge. Window shades and curtains spread out at full length. If there is a trunk or chest in the room, open it but let nothing stay in it. Open the pillows so that the gas can reach the feathers. Do not pile articles together.

With the room thus prepared, as is essential in any form of gaseous disinfection, crystals of potassium permanganate (16 ounces to each 1,000 cubic feet of room space) are placed in the container. Over this is poured "formalin," or the 37½ per cent aqueous solution of formaldehyde (16 ounces to every 1,000 cubic feet of room space), the temperature of the room must not be below 60° F. The formaldehyde gas is promptly liberated by the vigorous reaction of the formalin and potassium permanganate, and arises from the generator in immense volume in the form of an inverted cone. It is consequently necessary that all preparations be made in advance, and that the operator leave the room at once on the combination of the two chemicals.

The door or window of exit will be promptly closed and sealed and the room left closed for at least four hours.

As in all methods of disinfection, success largely depends upon the care which is exercised and the attention which is given to every detail. Simple as the method is, neglect of any of the following points may result in complete failure:

1. The room should be sealed and prepared as described.

2. The potassium permanganate (16 ounces to every 1,000 cubic feet of room space) should be placed in the apparatus or generator. *The permanganate must be put in before the formaldehyde solution.*

3. The 37½ per cent formaldehyde solution (16 ounces to the 1,000 cubic feet of room space) should then be poured over the permanganate.

4. As the gas is given off in immense volume immediately after the mixture of the formaldehyde and permanganate, the operator

must leave the room at once. All preparations must have been finished in advance.

5. The door or window of exit must be promptly closed and sealed, so that there will be no escape of gas, and the room should be left closed for four hours.

Whenever practicable, the special generator, previously described, should be used. In the absence of such a container, however, a milk pail may be used. The milk pail should be set, so as to fit snugly into a wooden or pulp bucket, or it may be wrapped tightly with several layers of asbestos paper. This is done to retain the heat within the generator and is very important to the proper generation of the gas.

Care must be taken not to place too much formaldehyde in a single container. The reaction is violent and there is great effervescence and bubbling. If the room is too large to be disinfected with one generator, use as many more as are required, and place in each only a reasonable amount.

The following quantities may be used safely in the containers recommended:

10 or 12 quart milk pail,	Formaldehyde, 16 ounces;
	Permanganate, 16 ounces.
14 quart milk pail,	Formaldehyde, 24 ounces;
	Permanganate, 24 ounces.
Special apparatus described above,	
	Formaldehyde, 32 ounces
	Permanganate, 32 ounces.

Sulphur fumes are valuable as a disinfectant chiefly because of their power of destroying animal carriers of infection such as mosquitoes, fleas, lice, and rats; they also have some value as destroyers of bacteria but they injure metals, fabrics, food-stuffs and colors.

Four pounds of rolled sulphur are required per 1,000 cubic feet of air space. The room must be tightly closed and all cracks and openings sealed; the sulphur broken in small pieces is placed in a pan and a small quantity of alcohol poured over it; the pan is then placed on bricks in a tub of water, the tub placed on a table, not on the floor, and the alcohol ignited. The water serves two purposes: it increases the efficiency of the sulphur dioxide by virtue of the vapor liberated by the heat of the burning sulphur, and it also lessens the danger of fire (Fig. 126).

Sulphur candles can be used instead of crude sulphur, but care must be taken to use sufficient candles. The average candle on the market contains one pound of sulphur. Three of these will be required in the disinfection of a small room, 10x10x10. Do not use a less number, no matter what directions may accompany the candle. The water-jacketed candle is preferable. Partly fill tin around candle with water and place candles in a pan on the table, not on the floor. Let one-half pint of water be vaporized with each candle. In the absence of moisture, the fumes of sulphur have no disinfecting power. Keep the room closed for 10 hours at least.

The *prevention of the spread of infectious diseases* requires absolute cleanliness, free ventilation, disinfection, and isolation, and in the

FIG. 126.— Burning Sulphur.

case of diseases such as malaria, yellow fever, dengue, typhus fever, plague, etc., which are carried by insects, protection from the insect carriers. In the bacterial diseases the infectious agent is usually contained in one or more of the excretions of the patient, depending upon the particular disease. As the bacteria can not get into the air from moist excretions these should not be allowed to dry, but should be disinfected and removed at once.

The dust of the ward becomes infected from excretory particles which have accidentally become dried; hence every care should be taken to avoid raising dust.

Flies and other insects may carry the infection on their feet or other parts of their bodies, therefore the discharges should be carefully protected from insects.

Sputum should be received in covered cups containing a one per cent solution of cresol, or five per cent formalin. Sometimes paper cups are used, the cups and contents being burned together.

Feces are best disinfected with milk of lime, ten per cent, or solution of chlorinated lime, four per cent.

Urine should be sterilized by adding sufficient carbolic acid to make a five per cent solution, or enough corrosive sublimate to make a solution of 1:1000.

In all cases the disinfectant solution employed should be equal in bulk to the material to be disinfected and should be thoroughly mixed with the excretion and allowed to stand at least an hour.

The vessels which have been used as containers should be boiled.

Infected clothing and bedding should be disinfected by steam, or formaldehyde gas in a tight chamber, but steam should not be used for woolens. If the infection is gross, as when the bed linen of a typhoid or cholera patient is soiled with feces, the articles should be soaked in a cold phenol or cresol solution containing two per cent of soft soap for several hours.

Boiling is applicable to linen or cotton fabrics.

Mattresses of which the hair is infected require steam under pressure, the ticking having been opened up.

Metal beds should be washed with five per cent solution of carbolic acid.

Disinfection of rooms: The contents of the room should not be removed. Articles of bedding and clothing should be hung on lines or the backs of chairs so as to expose as much surface as possible. The room must then be made practically airtight by sealing windows, doors, ventilating openings, and all other cracks and openings with strips of paper and ordinary flour paste. Formaldehyde gas or sulphuric-acid gas is then introduced in proper proportion and the room kept sealed for twenty-four hours.

The latest investigations indicate that this preliminary fumigation is of little value and may be omitted; the mechanical cleansing is the important feature.

The treatment of the walls and ceiling will depend upon their nature; if hard-finished or painted they should be scrubbed with hot water and soap, and then with an acid solution of corrosive sublimate, 1:1000, and repainted; a preliminary scrubbing of the walls with slices of stale bread is very effective for mechanical cleansing; bread so used should be burned. If the walls are calcimined or whitewashed they should be washed with soap and hot water, followed by ten per cent solution of chlorinated lime or five per cent of

phenol, and recalcimined; sublimate should not be used because it is decomposed by the lime. If the walls are papered the paper should be removed, after which the treatment is the same as for calcimined walls. Especial attention should be given to the lower parts of the walls, the first six feet from the floor.

All woodwork is to be scrubbed with soap and hot water, followed by corrosive sublimate; painted or varnished woodwork should be repainted or varnished. Floors with hard finish should have the old finish removed with turpentine and a new coat applied.

After the completion of the disinfection the room with all doors and windows open should be freely exposed to the action of sun and air for several days.

Disinfection of tentage: Everything should be removed from the tent for disinfection by the methods appropriate to each. The interior of the canvas, the poles, and the wooden floors, if any, should then be sprayed or washed with a two per cent solution of cresol or five per cent phenol. The tent is then removed to a new site, pitched inside out and exposed to the sun and air for twenty-four hours. The ground under the old tent floor should be policed and scraped, and sprinkled with a ten per cent solution of chlorinated lime or freshly slaked quicklime.

CHAPTER XI

INSTRUMENTS AND APPLIANCES

THE following is a brief description of those instruments and appliances which require explanation:

Explanation of Figs. 127 to 135.

Atomizer, hand: An instrument for producing a fine spray (Fig. 127).

Bistoury: A long, narrow knife, which is either straight or curved, sharp or blunt pointed (Fig. 128).

Bougie: An instrument used for dilating strictures (Fig. 129).

Bougie à boule: An instrument used to locate strictures (Fig. 130).

Bougie, filiform: A hairlike bougie for passing through tight strictures (Fig. 131).

FIG. 127.

Catheter: A tube for passing through the urethra into the bladder to draw off the urine. Catheters are made of silver, glass webbing, or rubber, of various sizes, and sometimes contain a wire called a *stylet* (Fig. 132).

Catlin: A double-edged amputating knife (Fig. 133).

Caustic-holder: A little case for holding caustic, usually made of gutta-percha or silver (Fig. 134).

Curette: An instrument used for scraping bones and unhealthy wounds (Fig. 135).

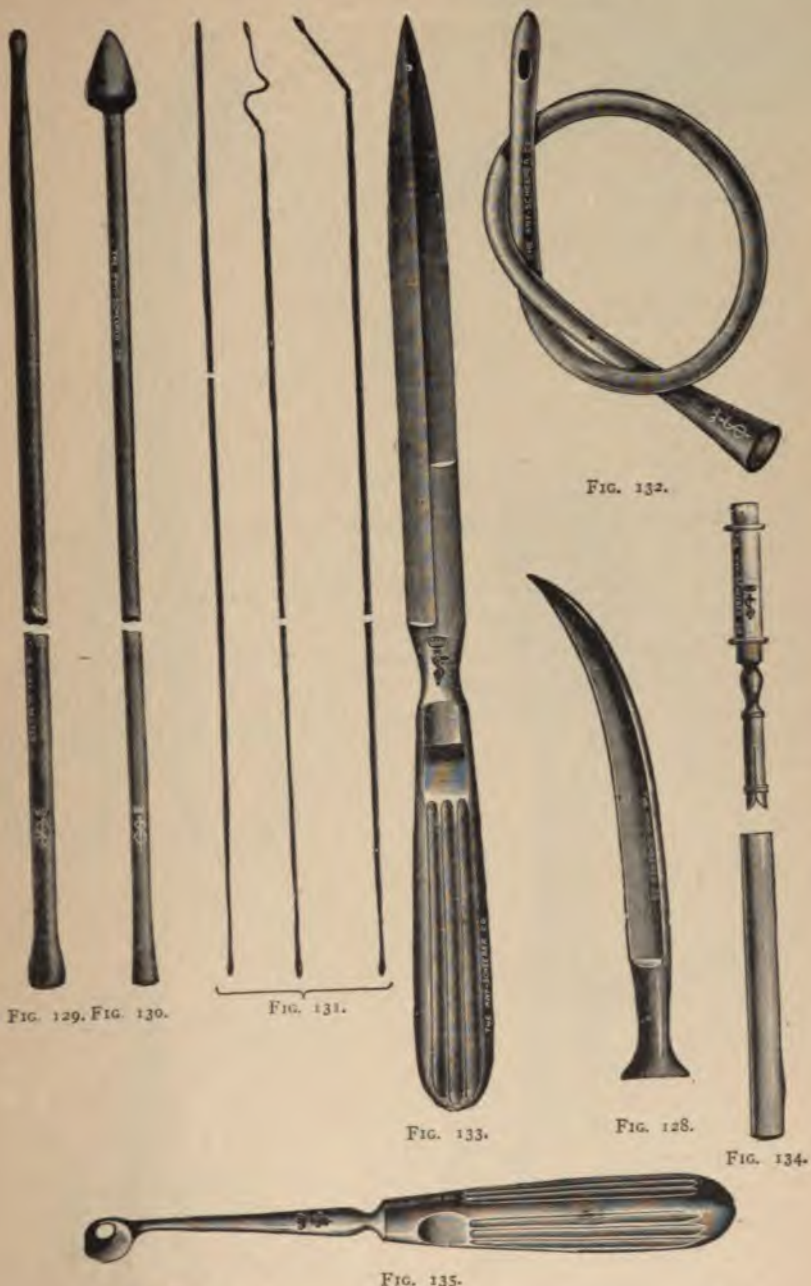

Fig. 129. Fig. 130.

Fig. 131.

Fig. 132.

Fig. 133.

Fig. 128.

Fig. 134.

Fig. 135.

Explanation of Figs. 136 *to* 139.

Cutting shears: A strong scissors for cutting plaster bandages (Fig. 136).

Clamp, pile: Ivory faced blades, to prevent burning of tissues while using thermocantery (Fig. 137).

Clamp, towel: Employed to secure the towel of gauze protector to the edges of the wound (Fig. 138).

Cooler, prostatic: For cooling and massaging the prostate gland (Fig. 139).

FIG. 136.

FIG. 139.

FIG. 138.

FIG. 137.

Explanation of Figs. 140 to 145.

Divulsor, urethral: For rapid dilatation and divulsion of strictures (Fig. 140).

Director: An instrument with a groove in which to guide the point of a knife (Fig. 141).

Drill, bone: An instrument for boring holes in bone (Fig 142).

Endoscope, urethral: For examination of the urethra (Fig. 143).

Forceps, bullet: An instrument with separate blades used for extracting bullets (Fig. 144).

Forceps, dental: An instrument used for extracting teeth (Fig. 145).

FIG. 142.

FIG. 143.

FIG. 144.

FIG. 140.

FIG. 145.

FIG. 141.

Explanation of Figs. 146 *to* 151.

Forceps, dissecting: Plain forceps used for dissecting purposes (Fig. 146).

Forceps, dressing: Forceps with scissor handles, used for removing old dressings from wounds and sores (Fig. 147).

Forceps, bone holding: For holding bone during operations (Fig. 148).

Forceps: Ear dressing (Fig. 149).

Forceps: Nasal dressing (Fig. 150).

Forceps, sterilizer: For removing instruments from sterilizer (Fig. 151).

FIG. 149.

FIG. 148.

FIG. 151.

FIG. 146.

FIG. 150.

FIG. 147.

Explanation of Figs. 152 to 157.

Forceps, tongue: For grasping and holding the tongue during anaesthesia (Fig. 152).

Forceps, gouge: A strong forceps, cutting at the points, so as to gouge bone (Fig. 153).

Forceps, hemostatic: Forceps for taking up arteries (Fig. 154).

Forceps, Liston's bone: A strong bone forceps for cutting bone in operations (Fig. 155).

Forceps, mouse-tooth: Forceps with fine, sharp teeth, used in dissecting (Fig. 156).

Forceps, needle-holder: A forceps to hold the needle in sewing wounds (Fig. 157).

FIG. 153.

FIG. 156.

FIG. 154.

FIG. 155.

FIG. 152.

FIG. 157.

Explanation of Figs. 158 *to* 164.

Forceps, sequestrum: A strong forceps for pulling away dead bone (Fig. 158).

Gag, mouth: An appliance for holding the mouth open (Fig. 159).

Gouge and chisel: For gouging and splitting bone (Fig. 160).

Head mirror: A round mirror worn on the forehead in the examination of the throat and ear (Fig. 161).

Inflator, Politzer: A rubber air bag with nozzle used in inflating the ear (Fig. 162).

Inhaler, chloroform: A framework covered with gauze or flannel for administering chloroform (Fig. 163).

Inhaler, ether, Allis: An appliance for the administration of ether (Fig. 164).

Fig. 158.

Fig. 161.

Fig. 163.

Fig. 159.

Fig. 162.

Fig. 160.

Fig. 164.

Explanation of Figs. 165 *to* 175.

Knife, amputating: Used for amputating a limb; a large one is used for amputating the thigh, a medium size for the leg, a small one for the arm (Fig. 165).

Knife, tenotomy. A small narrow knife for cutting tendons under the skin (Fig. 166).

Lachrymal probes: Small silver probes for introducing into the tube or duct leading from the eye to the nose (Fig. 167).

Lachrymal styles: Button-headed silver instruments for passing into the duct leading from the eye to the nose (Fig. 168).

Lancet: An instrument used for bleeding, vaccinating, and opening boils or small abscesses (Fig. 169).

Lavage tube, rectum: A large, soft-rubber tube for washing out the bowel (Fig. 170).

Lavage tube, stomach: A large, soft-rubber tube for washing out the stomach (Fig. 171).

Needle, aneurism: A curved, blunt instrument, with an eye near the end, used for passing a ligature under an artery (Fig. 172).

Needles: (a) An ordinary suture needle; (b) a cervix needle; (c) an intestinal needle; (d) a perineal needle. Needles are made in a very large variety of styles and sizes (Fig. 173).

Periosteotome: An instrument for separating the periosteum from bone (Fig. 174).

Probe: A silver-wire instrument for probing wounds (Fig. 175).

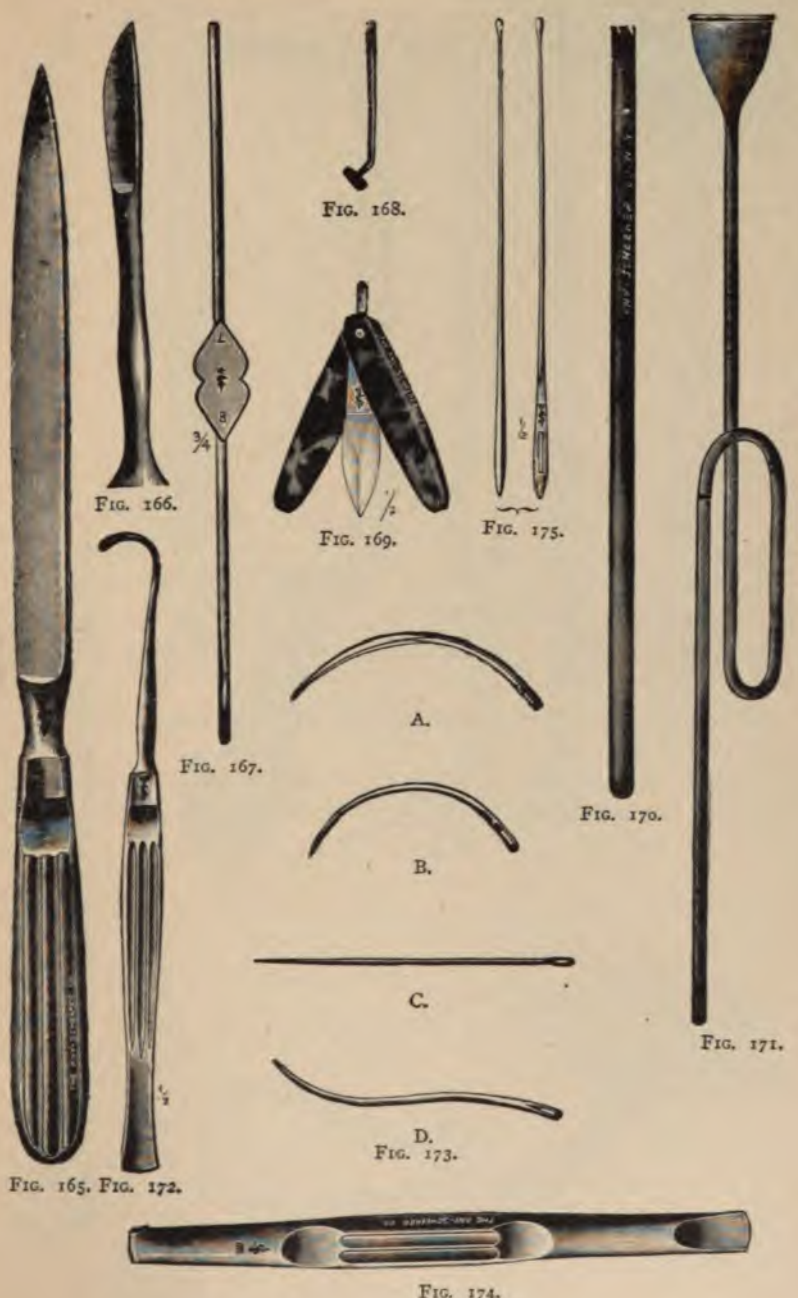
Fig. 168.
Fig. 166.
Fig. 169.
Fig. 175.
Fig. 167.
Fig. 170.
A.
B.
C.
D.
Fig. 173.
Fig. 171.
Fig. 165. Fig. 172.
Fig. 174.

Explanation of Figs. 176 *to* 181.

Retractor: An instrument for holding apart the edges of wounds in operating (Fig. 176).

Saw, amputating: A saw used for sawing the bone in amputations of the limb (Fig. 177).

Saw, Hey's: A small saw for cutting a piece out of a bone; used in operations on the skull (Fig. 178).

Saw, metacarpal: A small, straight saw for dividing the metacarpal bones (Fig. 179).

Saw, plaster of Paris: For breaking and removing plaster bandages (Fig. 180).

Scalpel: A short knife with a convex edge, made in different sizes and used for cutting and dissecting (Fig. 181).

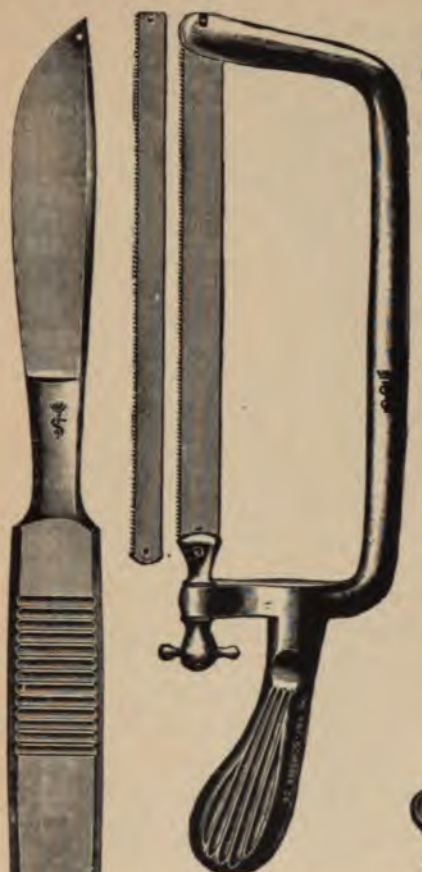

Fig. 177.

Fig. 176.

Fig. 179.

Fig. 178.

Fig. 181.

Fig. 180.

Explanation of Figs. 182 to 189.

Scissors: Straight (Fig. 182).

Scissors, curved. Scissors having the blades curved (Fig. 183).

Scissors, bandage: For cutting bandages, etc. (Fig. 184).

Sound: A metal instrument for dilating strictures or examining the bladder (Fig. 185).

Speculum, ear: A more or less conical cylinder for examining the ear. Usually in nests of different sizes (Fig. 186).

Speculum, eye: An instrument for holding apart the eyelids (Fig. 187).

Speculum, nose: A valved instrument for holding open the nostril (Fig. 188).

Sponge-holder: An instrument for holding sponges when operating in cavities (Fig. 189).

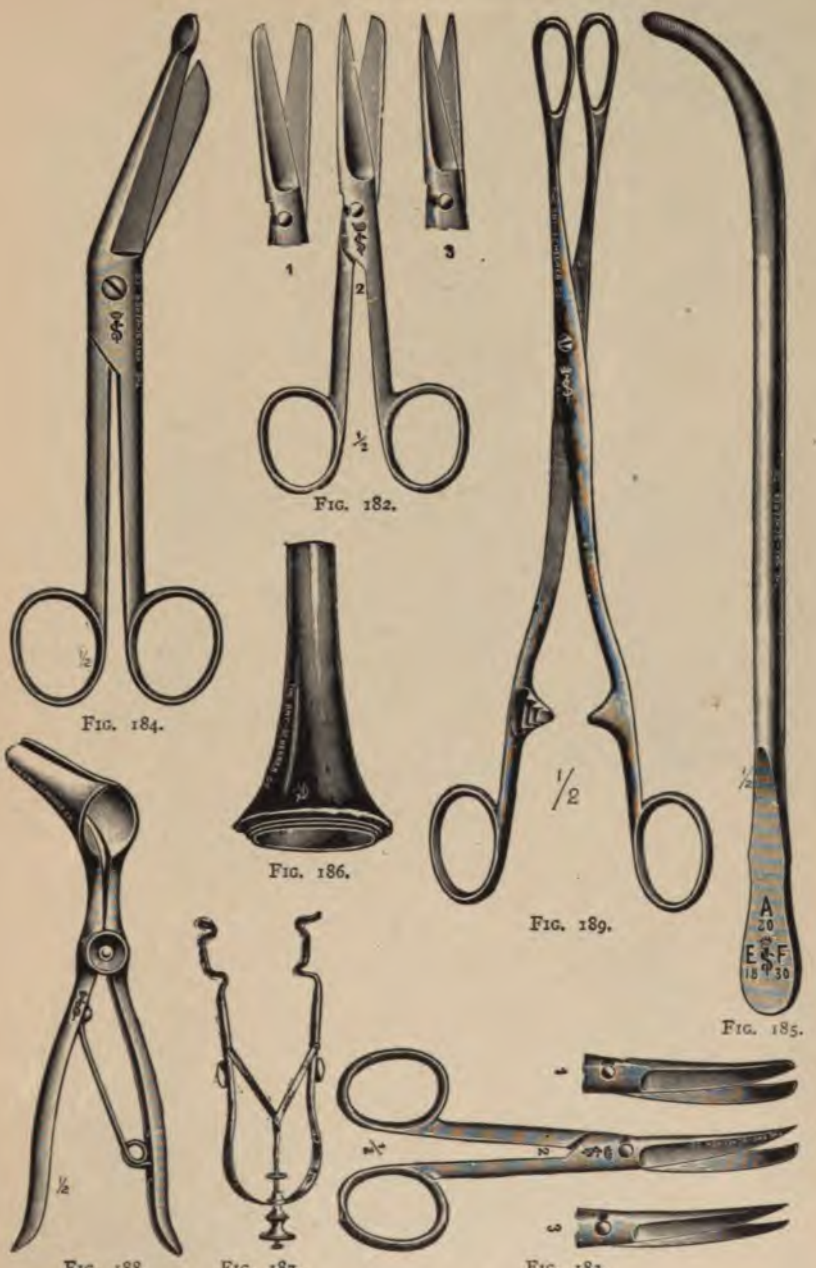

Fig. 182.

Fig. 184.

Fig. 186.

Fig. 189.

Fig. 185.

Fig. 188.

Fig. 187.

Fig. 183.

Explanation of Figs. 190 *to* 194.

Spectulum, rectal: For examination of the rectum (Fig. 190).

Spud and needle, eye: For removing foreign bodies from the eye (Fig. 191).

Searcher, stone: For ascertaining the presence of stones in the bladder (Fig. 192).

Syringe, urethral: For applying solutions into the urethra (Fig. 193).

Syringe, wound dressing: Also used for filling the bladder in conjunction with soft-rubber catheter (Fig. 194).

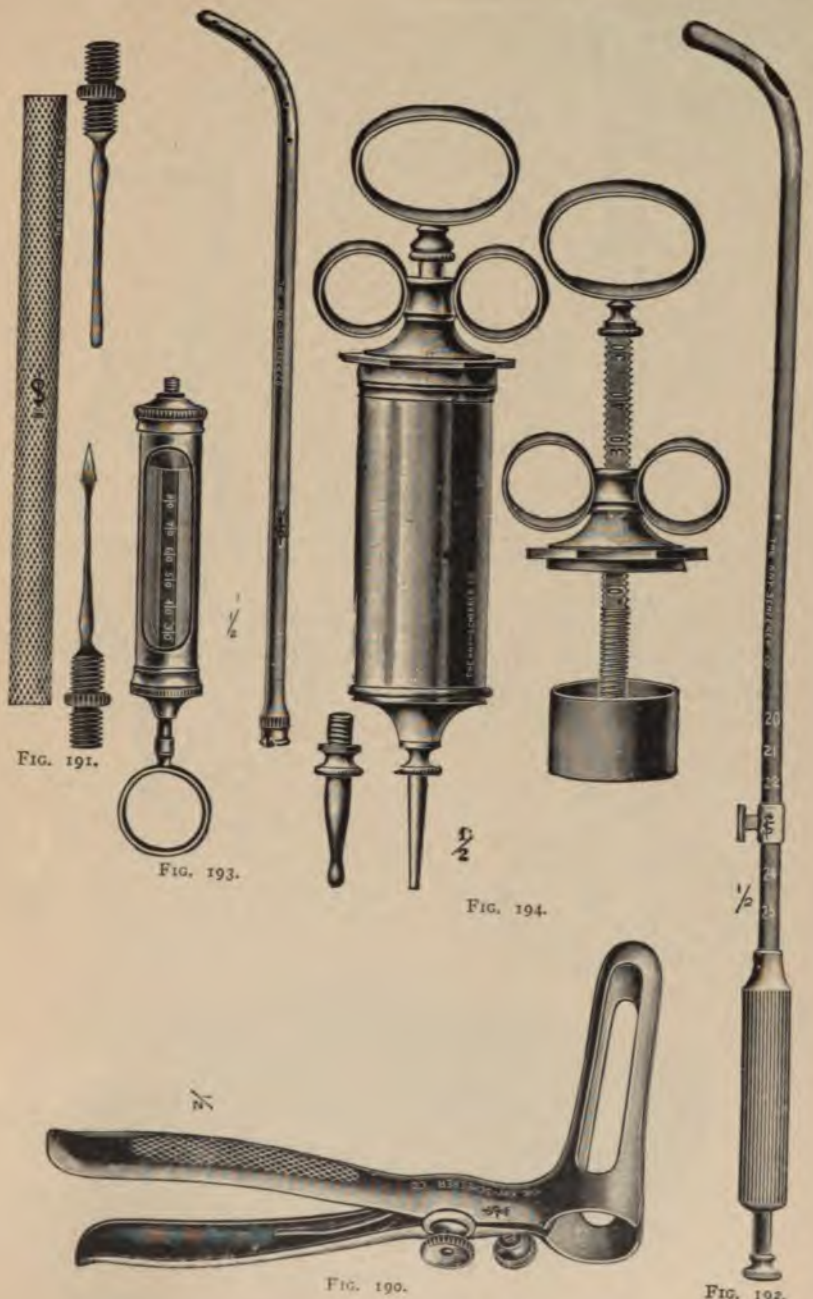

FIG. 191.

FIG. 193.

FIG. 194.

FIG. 190.

FIG. 192.

Explanation of Figs. 195 *to* 197.

Stethoscope: An instrument with which to listen to the sounds of the chest (Fig. 195).

Syringe, hypodermic: A graduated glass or metal syringe fitted with a hollow needle, employed in the injection of morphine and other medicines beneath the skin (Fig. 196).

Tenaculum-Forceps: (Fig. 197).

FIG. 195.

FIG. 197.

FIG. 196.

Explanation of Figs. [illegible]–[illegible].

Thermo-cautery Pugilin. A cautery in which the fuel is incandescent [illegible] (Fig. [illegible]).

[illegible] An appliance for holding down the tongue [illegible] (Fig. [illegible]).

Tonsilotome. An instrument for removing the tonsils (Fig. [illegible]).

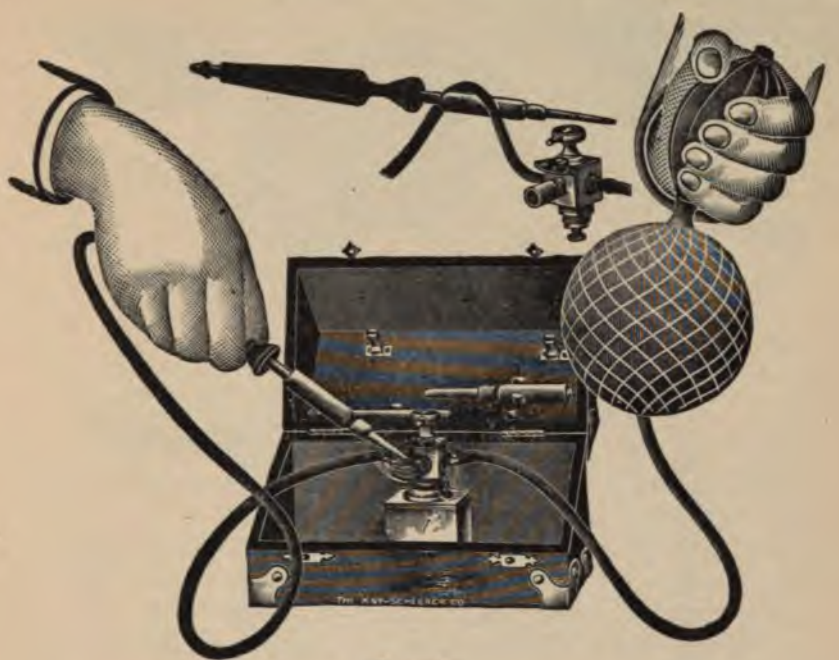

FIG. 198.

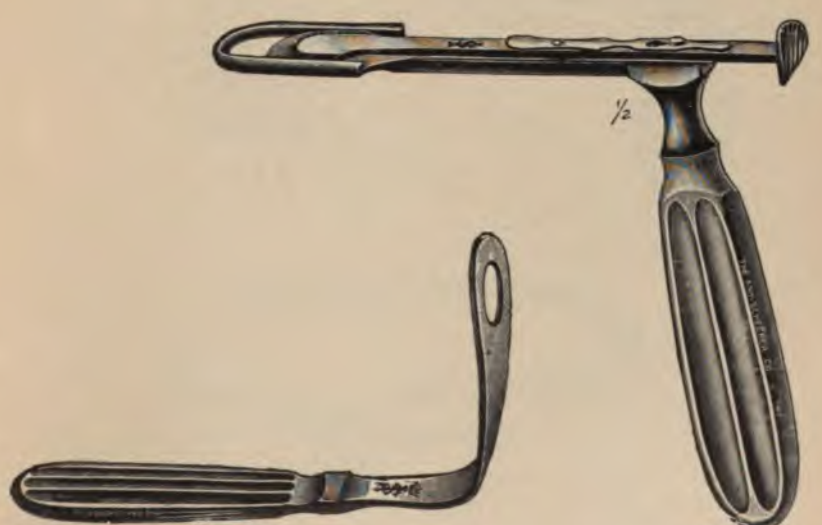

FIG. 199.

FIG. 200.

Explanation of Figs. 201 *to* 205.

Tourniquet: An instrument for making pressure on an artery to stop the flow of blood through it (Fig. 201).

Tracheotomy tubes: Two curved silver tubes, one fitting inside the other, used for putting into the wind-pipe when it has been opened by an operation called tracheotomy (Fig. 202).

Trephine: A circular saw used in operations on the skull (Fig. 203).

Trocar and cannula: A sharp pointed instrument and sheath for tapping collections of fluid (Fig. 204).

Truss: An appliance used in the treatment of rupture (Fig. 205).

FIG. 201.

FIG. 202.

FIG. 203.

FIG. 204.

FIG. 205.

Explanation of Figs. 206 to 208.

Beside the above there are certain special apparatus and cases:

Apparatus, compressed air: This consists of a metal air container, a force pump for compressing the air, tubing for connections, a cut-off for controlling the escape of the compressed air, and a set of spray tubes (Fig. 206).

Apparatus, electric: This is issued in several forms. The essential parts are the cells, which generate the current, the electrodes by which it is applied, the conducting cords, and the *coil* and *interrupter* in the case of a faradic battery (Fig. 207).

Apparatus, restraint: This is contained in a locked wooden box, and consists of a bed strap which is firmly fastened to the bed before the patient is placed upon it; a breast strap which fastens the patient to the bed strap and bed, anklets, wristlets, a muff, and a set of keys, by which the buckles of the apparatus can be locked (Fig. 208).

FIG. 206.

FIG. 207.

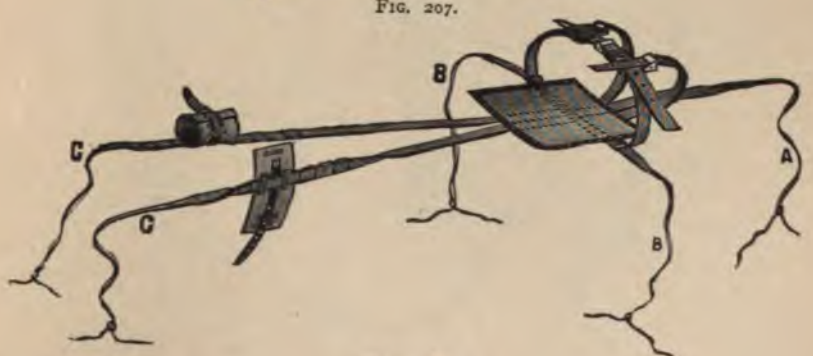

FIG. 208.

Explanation of Figs. 209 to 210.

ratus, steam sterilizing: For instruments and dressings (Fig.

ratus, infusion: For saline injection (Fig. 210).

FIG. 209.

FIG. 210.

Explanation of Figs. 211 to 213.

Apparatus, blood pressure: For determining the diastolic and systolic blood pressure in diagnosis of diseases of heart, arteries and kidney (Fig. 211).

Bottle, drop: For chloroform and ether (Fig. 212).

Case, aspirating: This consists of a rubber stopper containing a double current metal tube with stopcocks, a pump, aspirating needles, trocar and cannula, and tubing attachments. To use it a bottle in which the rubber stopper fits tightly must be supplied; the double current metal tube is connected on one side with the pump and on the other with an aspirating needle. The air is pumped out of the bottle, creating a partial vacuum, after which the stopcock connecting with the aspirating needle is opened and the fluid drawn off into the bottle (Fig. 213).

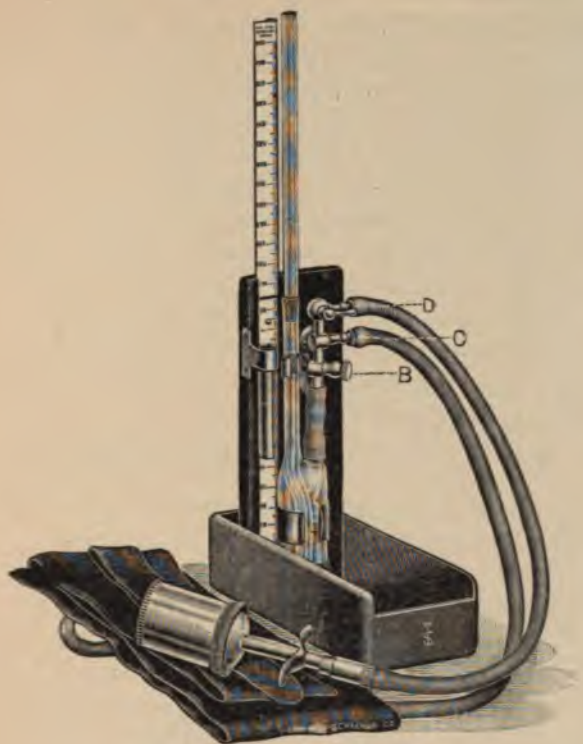

FIG. 211.

FIG. 212.

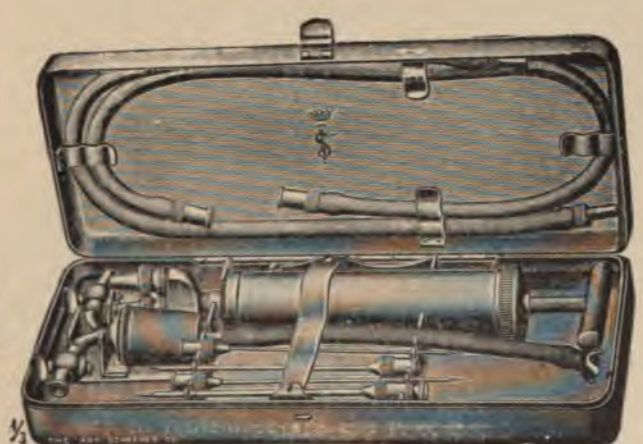

FIG. 213.

Case, emergency: This is a case for use of medical officers, containing a hypodermic syringe, clinical thermometer, a few simple instruments, and tablets of the most useful medicines.

In the field everything is made as light and portable as possible in order to reduce transportation. Appliances and equipment are packed in certain chests, cases, etc., which require some description.

Diagnosis Tags: A book of diagnosis tags with a pencil attached is contained in each orderly pouch. The diagnosis tags are made according to the following specifications:

Size 2½ by 5½ inches, provided with a copper wire four (4) inches long for fastening to the clothing.

Material to be linen, faced with paper.

All inks and colors used to be "*fast.*"

Twenty-five (25) or fifty (50) to be bound in a book with pasteboard covers.

Form to be as follows:

	Date and hour.....	(Blue.)	(White)
	Name and rank.....		
	Regiment or department.....		
	Diagnosis.....	Not able to walk.	Stub.
	.....		
	Treatment.....		
	Ambulance station.....		
	Field hospital.....		
	Signature.....		

FIG. 214.

The following directions should be printed on the inside of the cover:

1. In any wound or disease not rendering the patient unable to walk, detach the white body of the tag, leaving the colored border attached to the stub. In a wound or disease rendering the patient unable to walk, detach the entire tag, including colored border.

It will thus be always possible to ascertain by the number of colored borders left with the stubs how many of the patients treated were or were not able to walk.

2. Under "Diagnosis" note all essential facts, character of injury, parts involved, fracture, etc.

3. Under "Dressing Station" and "Field Hospital" note any additional treatment applied. If at either place it is deemed best not to evacuate a desperately sick or wounded patient any further, write the words "not transportable," or the initials "N.T."

4. Under "Remarks" on the back may be noted any important fact for which there is no room on the face, whether operation or treatment is urgently needed, the amount of stimulant or anodynes already administered, etc.

5. Fasten to button on clothing of patient over sternum or as near it as possible (Fig. 214).

Field desk: This is an iron-bound oak chest, with padlock, in a hinged case. It contains writing materials, blank books, and blank forms; their are two sizes, Nos. 1 and 2.

Food box: Contains hospital stores or containers for the same.

Commode chest: A box containing a bed pan, chamber pot, urinal, spit cup, and toilet paper.

Acetylene chest: A chest completely equipped with apparatus for illumination with acetylene gas.

The *regimental combat equipment* includes a medical and surgical chest, a water sterilizing bag, a box of surgical dressings and other necessary articles enumerated in par. 866 M. M. D.

Mess chests: This contains equipment to serve 25 persons.

Belt, web with pouch: This takes the place of the old hospital corps pouch. The pouch contains dressing forceps, scissors, pencil and book of diagnosis tags, while the belt provides ten pockets for field tourniquets, dressing packets, iodine swabs, bandages, sublimated gauze, adhesive plaster, pins and aromatic ammonia.

Chests, field laboratory. Nos. 1 and 2.

Chest, medical and surgical, supplementary.

Chest, tableware.

Saddle, pouch.

Venereal prophylaxis unit.

CHAPTER XII

THE OPERATING ROOM AND SURGICAL NURSING

In the chapter on infection and disinfection we have already spoken of bacteria in relation to disease; here we must consider them with special reference to surgical infections.

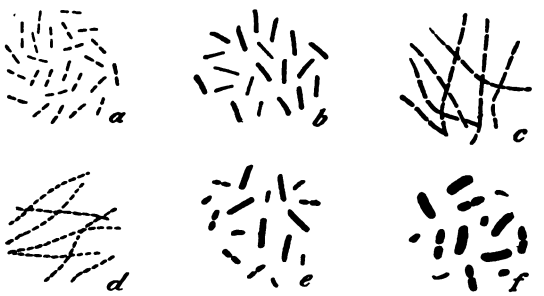

FIG. 215.— Various Types of Bacilli.

Bacteria may be divided into two general classes, *bacilli* or *rods*, (Fig. 215), and *micrococci* or *spherical bacteria* (Fig. 216); it is these latter that are specially concerned in wound infections. Micrococci may also be divided into two classes; those which are

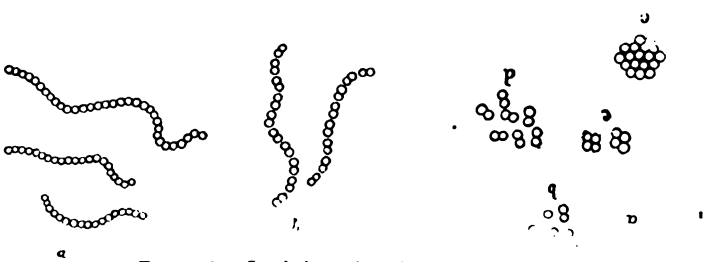

FIG. 216.— Staphylococci and Streptococci.

grouped in clusters like grapes, called *staphylococci*, and those arranged in chains, *streptococci;* the former are concerned in ordi-

nary suppurations such as boils and abscesses, while the latter are the active agents in septicemia and erysipelas.

Some bacteria produce *spores* or seed which are much harder to kill than the bacteria themselves.

We have already seen that *sepsis* means *putrefaction;* an *aseptic* wound is one that is *surgically clean,* that is free from all germs; antiseptics prevent putrefaction by destroying the germs or preventing their development. A wound offers just the conditions necessary for the growth of bacteria — heat, moisture, and abundance of nutritive material, and the bacteria are everywhere present, on the skin, on the clothes, instruments, and fingers, and in the air, so that if we are to avoid infection minute care is necessary. All disease germs in the process of their growth produce certain poisons, the nature and action of which vary with the particular germ. Yeast, which is really a mass of germs, in its growth in sugar solution produces alcohol, which when absorbed causes intoxication and, if in excessive amounts, death. The nux-vomica plant in its growth produces strychnine, one of the most powerful of all poisons. So with disease germs. The staphylococci in a wound cause inflammation and suppuration; if the poison is absorbed fever results, *toxemia* or *blood poisoning.* Streptococci have the same effect, and in addition frequently invade the blood themselves and grow there, producing *septicemia, pyemia,* and death.

Pyemia differs from septicemia only in that abscesses form at a distance from the original infection, especially in the joints, muscles, and lungs; the abscesses are caused by the pus cocci which reach those points through the blood.

The most important point in surgical nursing is absolute cleanliness on the part of the nurse; a nurse with dirty hands and finger nails is an abomination and should not be tolerated for a moment. It should be borne in mind that surgical infections are readily carried from one patient to another, and thorough cleansing and disinfection of the hands before dressing each case should be an invariable rule.

The *preparation of a patient for a major operation* usually begins the night before, when a laxative is given followed by an enema early in the morning of the operation.

About twelve hours before the operation the field of operation and the surrounding skin are shaved and then washed with hot water and soap; about six hours before the operation the skin is

wiped dry with a sterile towel and then moistened with tincture of iodine, and covered with dry sterile gauze.

If the operation is done in the morning no food is given after the light supper of the previous night, except perhaps an early cup of coffee. The urine is passed or drawn the last thing before going to the operating room; at the same time any false teeth are removed.

Just before the operation a second application of iodine is usually made, but many surgeons do not consider this necessary. The iodine is applied with a sterile swab.

In emergency operations the washing is omitted and the shaving done without soap because the iodine penetrates the skin better if it is perfectly dry.

After-care: While the operation is being done the bed has been prepared in the prescribed manner; when the patient is in bed a nurse is detailed to remain by him until the effects of the anesthetic have passed off. This is necessary as in his unconscious condition he may fall out of the bed, tear off his dressings, get up, or choke while vomiting, and be unable to help himself. Sometimes the patient may be in a condition of extreme shock, with cold, clammy skin, shallow breathing, and weak rapid pulse; in such a case hot-water bottles should be freely used, stimulants given, and the foot of the bed raised. After shock the next dangers to be looked for are hemorrhage and infection. Infection usually first manifests inself by a rise of temperature and chilly sensations; even aseptic cases, however, often have a temperature of about 100° F. for the first day or two, constituting what is known as *surgical fever*. In aseptic cases there is little for the nurse to do beyond the administration of diets, as the first dressings are not changed for a week or ten days. The urine usually has to be drawn every six hours for the first twenty-four hours, or until the control of the bladder is regained.

In surgical rounds the duty of the nurse is to have everything ready for any necessary *change of dressings*. Dressings may be done in the ward, or there may be a special dressing room to which the patients are taken on a litter. In the former case a movable dressing table or ward carriage is usually employed. Besides a liberal supply of sterilized dressings in glass jars there will be required bandages, safety pins, an irrigator, antiseptic and sterile normal saline solutions, scissors, dressing forceps, dissecting forceps,

basins, and a covered pail or paper bags for the soiled dressings, hot and cold water, soap, hand brushes, towels, and rubber sheeting.

Dressings are of two general types, *dry dressings and wet dressings;* the former are almost invariably used in aseptic wounds and consist of a pad of sterile gauze about half an inch thick, covered with a layer of absorbent cotton. *Wet dressings* are used in infected wounds and consist of a pad of sterile gauze soaked in a 1:2000 solution of corrosive sublimate or a two-per-cent solution of phenol; over this a layer of absorbent cotton, and then a piece of oil silk, rubber tissue, or waxed paper. Antiseptics are used in wet dressings because we wish to destroy the germs which we know are already present, and the whole dressing is covered by a *protective,* as we call the oil silk, because we wish to keep the dressing moist and so allow a more uniform diffusion of the discharges which always occur in infected wounds.

The operating room: The attendant in charge of the operating room must have a clear understanding of the technique of aseptic operating and must be a man of great carefulness and conscientious in details. He must remember always that surgical infections usually come from contact with something not surgically clean, and not from the air. The room itself must be clean and free from dust; it must be disinfected at frequent intervals and no dusting must ever be permitted there; instead the floors must be mopped and the walls wiped with cloths moistened with an antiseptic solution. The temperature of the room should be about 72° F., 80° F. in abdominal operations.

Sterilizers: There are two general types of sterilizers in use, the essential difference being that in one steam is used under pressure, and in the other the steam is flowing. Of the latter kind of sterilizer, the Arnold is a type. In hospitals, steam under pressure is always used.

The steam pressure sterilizer is known as an *autoclave.* It consists essentially of a metal cylinder with a tight fitting door, and provided with a steam pressure gauge, safety valve, air vent, thermometer, and apertures for the entrance of steam.

Outside the cylinder is a steam jacket, with a space between it and the cylinder, in which the steam circulates.

In sterilizing dressings, a pressure of fifteen pounds of steam for twenty minutes is usually employed.

If glassware is used in the sterilizer, it is necessary to put a folded towel or something of that nature, between the glass and the metal, to prevent breakage, and if liquids are contained in the glass, the door of the chamber should not be opened until the pressure within is reduced to the normal, otherwise the liquid may boil over or the stopper may be blown out.

The operating table is prepared by covering it with a folded blanket, over which is placed a rubber sheet and over that a sterilized sheet or a Kelly pad or surgical cushion may be used. On a small table by the head of the operating table are placed the appliances used in anesthesia.

Instruments are usually sterilized by boiling from two to five minutes in one-per-cent solution of soda, the soda being used to prevent rusting. As boiling dulls sharp instruments, these may be better sterilized by soaking in 95 per cent alcohol for half an hour.

Aluminum instruments are ruined by soda solution; they must be boiled in plain water.

Instrument trays, basins and pitchers, and rubber irrigators are boiled five minutes in plain water.

Dressings cut in proper sizes, bandages and gauze, sponges, towels, sheets, and operating gowns are wrapped in towels or sheets, pinned in small packages, and sterilized twenty minutes under fifteen pounds steam pressure. Besides the dry sterilized towels a number of damp towels sterilized by boiling should be ready to surround the field of operation and for other purposes.

Gauze sponges are prepared of four or five thicknesses of gauze about six inches square with the end sides folded in or stitched so that there will be no loose threads to be left in the wound.

Laparotomy pads are usually of several thicknesses, with the edges turned over and sewed, and with a tape fastened to one corner.

Gauze for packing is cut in long narrow strips, folded inward several times from the edges, and the strips then packed in glass tubes closed with cotton, before being sterilized.

In many hospitals gauze which has been used except in septic cases, is used over again after preparation as follows: Soak for several hours in cold water, with frequent stirring. Wash clean, under a running stream of tepid water. Boil for half an hour. Wring out dry, and then proceed as with new gauze.

Iodoform gauze is frequently used, especially for packing suppu-

rating wounds or abscess cavities; it is prepared as follows: Sterilize five yards of gauze; mix ten ounces of glycerin with an equal amount of water and boil fifteen minutes; add a half-ounce of iodoform to three ounces of alcohol and mix with the water and glycerin; then, while stirring briskly, immerse the gauze in the mixture; wring out and keep moist in a closed glass jar.

The *sutures* and *ligatures* ordinarily used are catgut, silk, silkworm gut, and silver wire; the three last named are sterilized by simple

FIG. 217.—Preparation of Gauze Sponges.

boiling in plain water. Catgut is not made from the gut of a cat, but from that of the sheep; being animal in nature it requires thorough sterilization, but will not stand boiling in water. Catgut in the army medical service is usually issued already sterilized, but most surgeons prefer not to rely on trade processes, and prepare their own animal sutures. There are many different methods employed; nearly all include as the first step the removal of the fat from the catgut by soaking forty-eight hours in ether which is changed daily.

Among the methods are boiling in alcohol, the iodine method, and the cumol method.

The iodine method is satisfactory and simple. The catgut without previous preparation is wound on glass spools in one layer and placed in a one-per-cent solution of iodine and iodide of potash in distilled water for one week; the spools are then withdrawn and kept in alcohol.

Boiling in alcohol. Wind the catgut on clean glass spools, soak in ether for twenty-four hours to remove grease, shaking several times during the period; remove from the ether and soak twenty-four

hours in alcoholic solution of corrosive sublimate 1:500; remove from sublimate solution and boil in 95 per cent alcohol over a water bath for ten minutes. Keep in same jar until required for use.

Metal and glass syringes with rubber or asbestos packing may be boiled; if the packings are leather draw boiling water into the syringe, immediately force it out, wash out several times with five per cent phenol, and soak in the same solution while full; the needles are boiled with the wires in place.

Rubber goods: Vulcanized rubber may be boiled for one minute: fountain and bulb syringes, drainage tubing, rubber bandages, rubber gloves and finger cots, soft-rubber catheters and bougies, may be boiled five minutes in plain water.

Hard rubber is spoiled by boiling; soak in five per cent phenol. Rubber tissue (gutta-percha) will not stand boiling: wash in cold water with green soap, rinse, immerse twenty-four hours in solution of corrosive sublimate 1:1000.

Web catheters and bougies will not stand heat; disinfect in an antiseptic solution.

Large quantities of *boiled water,* both hot and cold, will be necessary, also sterile normal saline solution, and freshly prepared antiseptic solutions — two per cent phenol and 1:2000 bichloride of mercury.

Normal saline solution is a 0.9 per cent solution of sodium chloride (common salt) in water. It is called "normal" because it has the same specific gravity as blood serum, which fact renders it less irritating than plain water. It is prepared by dissolving nine grammes of salt in a liter of boiling water and sterilizing in a glass flask, which is exposed to flowing steam in a steam sterilizer for a half-hour at a time on three successive days. This method of fractional sterilization is more successful than a single sterilization for an hour and a half because, while a single exposure of half an hour will kill all the adult bacteria, the *spores* or *seeds* are more resistant; the intervals of twenty-four hours allow the development of the spores which are then killed by the next sterilization. The mouth of the flask is closed with nonabsorbent cotton which is drawn over the lip of the flask and held in place by a piece of gauze. In the absence of normal saline tablets or exact means of measurement, the proper amount of salt may be approximated by using a scant teaspoonful to a pint of water. In emergency the water is simply boiled five

minutes instead of being subjected to fractional sterilization. When used for intravenous or subcutaneous infusion the solution should be filtered just before use.

Drainage may be tubular or capillary; for the former, rubber or glass drainage tubes are employed. Rubber drains are prepared for use by wasing with soap and water, rinsing, boiling five minutes, and keeping in a three-per-cent solution of phenol frequently changed. Glass drains are boiled. For capillary drainage we use a few strands of catgut or horsehair, or the so-called "cigarette drain." The "cigarette drain" is prepared by rolling a strip of gauze of the proper size in a piece of gutta-percha tissue, just as tobacco is rolled in a paper to make a cigarette. For capillary drainage we use strips of gauze about an inch wide and free from any loose threads, or a few strands of silkworm gut may be employed.

The most important part of the whole preparation is the *disinfection of the hands and forearms* of the operator and his assistants. Many different methods have been recommended for this purpose, and, while none are capable of making the hands germ free, most of them give satisfactory results. In all the methods there are two steps; first mechanical cleansing; second, chemical sterilization; the first is by far the most important.

An excellent method of mechanical cleansing is as follows: After trimming the nails close remove all dirt from beneath them with a nail cleaner; anoint the hands with soft soap or a liniment of soft soap, and rub thoroughly with a mixture of equal parts of corn-meal and powdered mustard; wash in running hot water and thoroughly scrub for five minutes with a stiff brush recently boiled; pay especial attention to the edges of the nails; again clean the nails with a sterile cleaner, rinse the hands in boiled water, immerse in alcohol, and scrub five minutes, using gauze sponges.

Most surgeons prefer to use freshly boiled rubber gloves, but even with the gloves sterilization must be done just as thoroughly, as gloves are often punctured or leaky.

The field of operation is prepared by painting it with tincture of iodine; only so much of the surface as is necessary is exposed, all the rest of the body being protected by a blanket covered with sterile sheets; immediately around the operating field wet antiseptic or sterile towels are used.

The sterilization of the hands is usually done after the operating gowns or suits are put on, and once done nothing should be touched which is not sterile; this is the rule which is most frequently broken by the inexperienced nurse; in his hurry or excitement he picks up something which is not sterile and then he must disinfect his hands again.

Frequently during the operation the surgeon will wish to wash his hands to remove blood, so that a basin of sterile water must be kept ready at hand.

After the operation the room must be immediately cleaned. All unused animal sutures which have been handled should be thrown away; soiled or bloody towels, sheets, etc., placed to soak in cold water and the instruments cleaned, counted, and put away.

To clean the instruments they are taken apart and washed in cold water to remove the blood, paying special attention to serrated parts, they are then washed in hot water and soft soap, rinsed, and thoroughly dried. Instruments which have been used in an infectious case must be sterilized before being cleaned. *Scalpels* and other cutting instruments must be cleaned separately, taking particular care not to dull the cutting edge. Needles should be dipped in alcohol, thoroughly dried, and placed in a box with lycopodium.

Artery forceps which take apart usually have the same number stamped on the corresponding blades; if they do not, they should be cleaned one by one, so as not to get them mixed. Locks, screws, holes, and depressions must be carefully cleaned and dried with wisps of absorbent cotton.

Rouge and putz-pomade may be used to remove rust and stain.

The leather packing and washers of *syringes* must be kept moist by frequent use of water or glycerin, and such syringes should always be tested before use to see that they are in working order.

Fountain syringes after washing should be hung bottom up to dry, after which their mouths should be plugged with cotton to exclude dust.

Rubber catheters after drying are to be kept in talcum.

Rubber bandages in like manner are to be dusted with talcum and rolled up, tapes, if any, inside; they must be protected from the air by inclosure in a tin box with the top secured with a strip of rubber plaster.

Rubber gloves should be thoroughly dried with a towel, dusted

with talcum inside and out, and protected from the air in tin boxes. Punctures may be closed with rubber cement, or patched with a piece of an old glove by the aid of the cement.

In the field many of the conveniences of the operating room in the post hospital are absent, yet very excellent results may be obtained. The work must be done in a tent, or even with no more shelter than a fly; under such circumstances dust is one of the greatest dangers to be guarded against. If possible no movement of troops or wagons should be allowed in the immediate vicinity; the floor of the tent and the grounds around it should be thoroughly sprinkled to lay the dust, and wet sheets may be hung up so as to afford further protection to the wounds. If no soda is available to boil the instruments, wood ashes may be used tied up in a bag to avoid clouding the water; when steam sterilizers cannot be had the dressings may be boiled, or, in the absence of fire, saturated with antiseptics. When the water is very hard, muddy, or full of organic matter, bichloride of mercury is so rapidly decomposed that it should not be relied upon as an antiseptic; phenol should be used instead. If there are no receptacles large enough to boil the trays they should be scalded with boiling water, and strong antiseptic solutions allowed to stand in them for a half-hour before use.

In the absence of other suture material *horsehair* answers very well; it may be rendered aseptic by washing with soft soap and water, boiling ten minutes in 0.25 per-cent solution of soda and then ten minutes more in plain water, after which it is kept in a 1:1000 alcoholic solution of corrosive sublimate.

[illegible] is the [illegible] reason this [illegible] in the back, over [illegible] below the clavicle. [illegible] and not into the muscles nor [illegible] for any other operation.

Tincture of iodine painted over the dry skin, before and after the injection, has proven satisfactory.

The ampule should be washed off in an antiseptic solution and opened after making one or more cuts near the top with a file. The vaccine can be drawn out of the container with a syringe, or it may be emptied into a shallow glass dish, such as a salt cellar, which has been sterilized by boiling.

The syringe and needle should be sterilized by boiling in two-percent soda solution. To insure perfect sterilization, draw the piston out to its full length, or remove it entirely, so that the barrel is full of water during the boiling. A fresh needle should be used for each man, or, if one needle must be used on two or more men, it should be resterilized before each injection.

Among the more common infectious diseases are gonorrhea, chancroid, syphilis, typhoid fever, malaria, yellow fever, cerebro-spinal fever, dysentery, cholera, diphtheria, tuberculosis, influenza, tonsillitis, mumps, erysipelas, and wound infections.

Typhoid fever: This disease is due to infection with the typhoid bacillus, which always gains entrance to the body through the mouth, and escapes from the body of the typhoid patient in the stools and urine and occasionally in the sputum. The germs are usually swallowed in infected water or food, but may get into the mouth indirectly as when one has been handling infected clothes, bedding, or other articles, and then handles food without washing the hands. The urine of the typhoid patient often contains typhoid germs for weeks after the patient is convalescent, hence the danger of urinating on the ground, where the germs grow readily and, getting on the shoes of the soldier, are carried into barracks.

The initial lesion of typhoid fever is usually ulceration of the lower end of the small intestine, and this ulceration causes diarrhea and may go deep enough to cause hemorrhage or even perforation of the bowel. Sudden collapse in the course of typhoid fever is usually caused by either perforation or hemorrhage.

The fever ordinarily lasts about four weeks.

For his own protection the nurse should submit himself to prophylactic vaccination against typhoid and in addition must be careful to thoroughly wash and disinfect his hands every time after handling his patient, and again before eating. For the protection of others he must disinfect immediately all urine and stools, and every-

thing which may have been soiled by them, such as bedding, towels, nightclothes, etc. Even the water which has been used in bathing the patient must be regarded as infected; it should never be emptied on the ground, but into a sink which is afterward flushed with a disinfectant solution.

Separate thermometers, feeding cups, etc., must always be used, but if this is not practicable they must be disinfected before use with other patients.

As flies carry the disease germs on their feet they must not be allowed to reach the patient or his discharges. Clothing and bedding must be disinfected.

Dysentery: This occurs in two principal forms, amebic or tropical dysentery, and bacillary or epidemic dysentery. In both forms the germs are swallowed with water or food, chiefly the former, and in both they are thrown off in the stools.

The disease is therefore spread much like typhoid fever, and the precautions to be taken are practically the same, except that the urine in dysentery is not infectious.

Cholera: This disease is spread in the same way as dysentery, but is of short duration and very fatal. The only safety lies in eating and drinking nothing which has not been recently cooked.

Clothing and bedding must be disinfected, and also of course the stools and vomited matter.

Malaria: In this disease the infection is in the blood and cannot be carried from one person to another except by mosquitoes (the *anophelina*), which, after biting the malarial patient, then bite a person hitherto well. Therefore, the sick must be protected against mosquitoes, so that the mosquitoes can not get the disease, and the well must be also protected, so that if there are any infected mosquitoes about they may not do any harm.

Yellow fever: This disease resembles malaria in that the infection is in the blood, and can only be carried by the mosquito (*Aedes calopus*); the precautions to be taken are the same. It is, however, a much more serious malady than malaria, and usually of much shorter duration. A curious feature of the disease is that it is not infectious, that is, cannot infect the mosquito, after the end of the third day; but the mosquito once infected is capable of carrying the disease to man probably as long as she (the mosquito) lives.

Cerebro-spinal meningitis: In this disease it is believed that the

infective germ usually gains access to the body through the throat and nose and is frequently received from meningococcus carriers, or persons who have been in contact with other cases or themselves recently had the disease and still carry the coccus in their throats. This being the case, it is necessary to carefully disinfect all discharges from the throat and nose of the patient and also that nurses and physicians who come in contact with cases of this disease should frequently spray their own throats and noses with an antiseptic solution. Inasmuch as we do not know just how contagious the disease is, nor in what excretions the meningococcus leaves the bodies of the sick, all cases and their attendants must be carefully isolated, and all discharges from the patient and everything which has come in contact with him, including the room in which treated and its contents, must be thoroughly disinfected.

Gonorrhea or clap: There is no danger of contracting this disease in its ordinary form except through sexual intercourse, but there is danger of getting some of the pus into the eyes and thereby inducing a very serious inflammation which often completely destroys vision. This may happen to the patient himself by bringing the unwashed hands, after handling the penis, in contact with the eyes, or more commonly to the nurse or other innocent person, from use of a towel on which the gonorrhea patient has managed to get some of the pus from his penis. Such a patient should be cautioned about the danger to his own eyes, and should not be allowed to use any toilet articles except his own.

Chancroid: While this disease is nearly always venereal, a nurse with a hang-nail or other abrasion may inoculate himself while dressing the sore or the resulting bubo.

Syphilis: Syphilis, though very contagious at certain times and under certain conditions, is not always so. The chancre, mucous patches, condylomata, and the blood during the first few years of the disease, are all contagious. The mucous patches, being often located in the mouth and throat where they are not visible, are especially dangerous. All the table ware, toilet articles, instruments and appliances, and bed linen used by syphilitics should be kept entirely separate from those used by others, and should be frequently disinfected. Should the nurse have any cut or abrasion on his hands he must be exceedingly careful in handling the syphilitic lesions, or the dressings which have been used on them.

Pulmonary tuberculosis: In this disease the infection is contained in the sputum. As long as the sputum is moist the germs can not escape into the air, but they may be carried by flies which alight upon it or in the fine spray which is thrown out when the patient coughs. The danger is in the dry sputum which becomes pulverized and mixed with dust; hence it must be kept moist and always received in a disinfectant solution. If paper spit cups are used, these with their contents are burned. Clothing and bedding must be disinfected.

Pneumonia, like tuberculosis, is infectious through sputum which must be treated in the same way as that of the latter disease. Clothing and bedding must be disinfected.

Influenza; or "the Grip": In this disease the sputum is infectious and also the nasal discharge when there is any. The sputum is to be treated like that of pneumonia and tuberculosis, the nasal discharges are to be received on small pieces of gauze or toilet paper and immediately burned. Clothing and bedding must be disinfected.

In follicular tonsillitis the discharges from the nose and throat are infectious and should be handled in the same way as those of influenza.

The same remark applies to *diphtheria,* but this disease is very contagious through particles of the membrane which is present in the throat and often in the nose, and may be coughed into the face of the attendant; minute portions of the membrane lodged in the eye, nose, or mouth of the attendant may reproduce the disease in him. Patients with diphtheria should always be isolated. Clothing and bedding must be disinfected.

Measles belongs to the class of *eruptive fevers,* which includes also *scarlet fever, smallpox,* and *chicken pox,* all of which are contagious the infectious agent being inhaled or swallowed. Though there is reason to believe that they are all germ diseases, that supposition has not been proven for any of them. The discharges from the throat and nose are highly infectious, as are also the skin lesions in smallpox. The modern belief is that this class of diseases, like erysipelas and other wound infections, is spread chiefly if not entirely by persons or things which have been in contact with other cases. The general rules for nursing infectious diseases are to be followed and all discharges disinfected. Before the convalescent

is allowed to mix with well people he should be given an antiseptic bath, 1 :2000 bichloride, and the hair and scalp thoroughly shampooed.

Mumps: In *mumps* the contagious agent is probably in the secretions of the mouth and throat. The disease is to be handled like eruptive fevers.

Erysipelas may be carried from one wound to another on the hands of the nurse, on instruments, dressings, etc., and possibly also through the air. So very contagious is it that an erysipelas patient should be isolated and his nurse should not go near any one with a wound.

Wound infections are readily carried from one patient to another in the same way as erysipelas is transmitted. A nurse who dresses infected wounds should not attend those whose wounds are aseptic.

As hospital corps men serving in the tropics occasionally have to nurse cases of *plague,* it is necessary that they should know something of that disease.

The most prominent symptoms of plague are great prostration, high fever, and the development of buboes, most commonly in the groin; but buboes are not always present. The disease is due to a bacillus which is found in the blood and all the discharges, including the pus from the buboes, the urine, feces, sputum, etc. It is contagious and everything about the patient becomes infected, especially the locality. It may be conveyed by dust, food, water and clothing, by rats, mice and flies, and probably by ants and mosquitoes. Often the infection occurs through some slight wound of the skin. Plague patients should be isolated and everything which comes in contact with them disinfected. Rats and vermin of every sort must be systematically destroyed, and the utmost cleanliness insisted upon. No one with a wound, sore, or even a scratch, should nurse plague patients or visit an infected locality. Nurses should wear leggins and should frequently disinfect their hands, mouths, and nostrils.

In *typhus fever* the infection is conveyed by the bite of the body louse; probably also by the head louse and "crab" louse.

The body and clothing of the patient must be thoroughly disinfected in such a way as to kill all lice and their eggs; then there will be no danger of catching the disease provided the surroundings of the patient are also clean and free from vermin.

PART V

MESS MANAGEMENT AND COOKING

CHAPTER I

MESS MANAGEMENT

THE management of the hospital mess is one of the most important duties pertaining to the hospital corps, as upon its success depends not only the welfare of the patients, but much of the contentment and happiness of the men themselves. The noncommissioned officer selected for this assignment must be not only a man of intelligence and business capacity, but also one who has had actual experience in the kitchen.

The sources from which the mess is supplied are the rations issued for the hospital corps; a variable money allowance per day for each enlisted man sick in hospital; the hospital fund; the products of the hospital garden, chickens, and cows, and, in the field, hospital stores.

A ration is the allowance for the subsistence of one person for one day. The *garrison ration* is intended for troops in garrison, and, in time of peace, for troops in maneuver camps; the ration to be issued to troops on the march in time of peace will be prescribed by the commander, and will not exceed the allowances prescribed for the garrison ration: the *travel ration* is for troops traveling otherwise than by marching and separated from cooking facilities; the *reserve ration* is carried on the person of the men and in the trains, and constitutes the reserve for field service; the *field ration* is the ration prescribed in orders by the commander of the field forces; the *Filipino ration* is for use of the Philippine Scouts; and the *emergency ration* for troops in active campaign for use on occasions of emergency or in the field for purposes of instruction.

In time of war when Philippine Scouts are serving in the field they will be subsisted the same as are regular troops. When impracticable for Philippine Scouts to use the Filipino ration while traveling otherwise than by marching, on account of the lack of cooking facilities or for other reasons, the travel ration may be prescribed.

The kinds and quantities of the component articles of the Army

ration and the substitutive equivalent articles which may be issued in place of such components are as follows:

I. GARRISON RATION.

Component articles and quantities.	Substitutive articles and quantities.
Beef, fresh ..... 20 ounces	Mutton, fresh ..... 20 ounces.
	Bacon[1] ..... 12 ounces.
	Canned meat, when impracticable to furnish fresh meat. 16 ounces.
	Hash, corned beef, when impracticable to furnish fresh meat. 16 ounces.
	Fish, dried ..... 14 ounces.
	Fish, pickled ..... 18 ounces.
	Fish, canned ..... 16 ounces.
	Turkey, dressed, drawn, on Tranksgiving Day and Christmas, when practicable. 16 ounces.
Flour ..... 18 ounces	Soft bread ..... 18 ounces.
	Hard bread, to be ordered issued only when the interests of the Government so require. 16 ounces.
	Cornmeal ..... 20 ounces.
Baking powder .. 0.08 ounces.	
Beans ..... 2.4 ounces ...	Rice ..... 1.6 ounces.
	Hominy ..... 1.6 ounces.
Potatoes[2] ..... 20 ounces	Potatoes, canned ..... 15 ounces.
	Onions, in lieu of an equal quantity of potatoes, but not exceeding twenty per cent of total issue.
	Tomatoes, canned, in lieu of an equal quantity of potatoes, but not exceeding twenty per cent of total issue.
	Other fresh vegetables (not canned) when they can be obtained in the vicinity or transported in a wholesome condition from a distance, in lieu of an equal quantity of potatoes, but not exceeding thirty per cent of total issue.
Prunes ..... 1.28 ounces ..	Apples, dried or evaporated..... 1.28 ounces.
	Peaches, dried or evaporated..... 1.28 ounces.
	Jam, in lieu of an equal quantity of prunes, but not exceeding fifty per cent of total issue.
Coffee, roasted and ground. 1.12 ounces ..	Coffee, roasted, not ground..... 1.12 ounces.
	Coffee, green ..... 1.4 ounces.
	Tea, black or green..... 0.32 ounce.
Sugar ..... 3.2 ounces.	
Milk, evaporated, unsweetened. 0.5 ounce.	
Vinegar ..... 0.16 gill	Pickles, cucumber, in lieu of an equal quantity of vinegar, but not exceeding fifty per cent of total issue.
Salt ..... 0.64 ounce.	
Pepper, black.... 0.04 ounce	
Cinnamon ..... 0.014 ounce ..	Cloves ..... 0.014 ounce.
	Ginger ..... 0.014 ounce.
	Nutmeg ..... 0.014 ounce.
Lard ..... 0.64 ounce.	
Butter ..... 0.5 ounce	Oleomargarine ..... 0.5 ounce.
Sirup ..... 0.32 gill.	
Flavoring extract, lemon. 0.014 ounce ..	Vanilla ..... 0.014 ounce.

[1] In Alaska, 16 ounces bacon, or, when desired, 16 ounces salt pork, or 22 ounces salt beef.

[2] In Alaska the allowance of fresh vegetables will be 24 ounces instead of 20 ounces, or canned potatoes, 18 ounces instead of 15 ounces.

NOTE.—Food for troops traveling on United States Army transports will be prepared from the articles of subsistence stores which compose the ration for troops in garrison, varied by the substitution of other articles of authorized subsistence stores, the total daily cost per man of the food consumed not to exceed 20 per cent more than the current cost of the garrison ration, except on Thanksgiving Day and Christmas, when 60 per cent increase over the same current cost is authorized.

One day in each alternate month of the season of practical instruction, not exceeding three days in each year, the use of the reserve ration with individual cooking will be required by all troops in the field for purposes of instruction.

2. TRAVEL RATION.

Component articles and quantities.	Substitutive articles and quantities.
Soft bread..... 18 ounces	Hard bread ..... 16 ounces.
Beef, corned..... 12 ounces	Hash, corned beef..... 12 ounces.
Beans, baked..... 4 ounces.	
Tomatoes, canned. 8 ounces.	
Jam ..... 1.4 ounces.	
Coffee, roasted and ground. 1.12 ounces.	
Sugar ..... 2.4 ounces.	
Milk, evaporated, unsweetened. 0.6 ounce.	

3. RESERVE RATION.

Component articles and quantities.	Substitutive articles and quantities.
Bacon ..... 12 ounces.	
or meat canned. 16 ounces.	
Hard bread..... 16 ounces.	
Coffee, roasted and ground. 1.12 ounces.	
Sugar ..... 2.4 ounces.	
Salt ..... 0.16 ounce.	

4. FIELD RATION.

The field ration is the ration prescribed in orders by the commander of the field forces. It consists of the reserve ration in whole or in part, supplemented by articles of food requisitioned or purchased locally, or shipped from the rear, provided such supplements or substitutes correspond generally with the component articles or substitutive equivalents of the garrison ration.

5. FILIPINO RATION.

Component articles and quantities.	Substitutive articles and quantities.
Beef, fresh..... 2 ounces	Bacon ..... 3 ounces.
	Canned meat ..... 5 ounces.
	Fish, canned ..... 12 ounces.
	Fish, fresh ..... 12 ounces.
Flour ..... 8 ounces	Hard bread ..... 8 ounces.
	Soft bread ..... 8 ounces.
Baking powder, when in field and ovens are not available. 0.32 ounce.	
Rice, unpolished.. 20 ounces.	
Potatoes ..... 8 ounces	Onions ..... 8 ounces.
Coffee, roasted and ground. 1 ounce.	
Sugar ..... 2 ounces.	
Vinegar ..... 0.08 gill.	
Salt ..... 0.64 ounce.	
Pepper, black.... 0.02 ounce.	

Scout organizations will be required to use the entire allowance of the meat component, and not more than 16 ounces of rice per day to be used for each ration. The purchase of 1.6 ounces of beans per ration in substitution of the portion of the rice ration not drawn will be made, and use of as large an extent as possible of native products, such as camotes, mongos, and squash will be required.

6. EMERGENCY RATION

The emergency ration is furnished, in addition to the regular ration, as required for troops on active campaign or in the field for purposes of instruction, and will not be opened except by order of an officer or in extremity, nor used when regular rations are obtainable.

Ration returns upon which emergency rations are drawn will bear the certificate of the organization commander that such rations are required for the enlisted men of his organization and that the money value of any rations previously drawn by him, and improperly opened or lost, has been charged against the person responsible.

All articles of the garrison, travel, or Filipino ration due a company, or other military organization, will be retained by the commissary and credit given to the organization for the money value of these articles at the current price of the articles; and the commissary will pay as savings to the organization commanders any excess in value of the stores so retained over those purchased by the organization.

The revenue from this source as well as that from the post bakery (savings on flour), the post exchange, and the care of patients other than soldiers in hospital constitutes the *hospital fund*, which may be expended as far as desirable in giving greater variety and abundance to the mess of the hospital corps.

Variety in the mess is of much importance and may be obtained through the use of the alternative issues, by purchases from the hospital fund, and especially by variety in cooking. Usually bills of fare are prepared by the noncommissioned officer in charge of the mess and submitted to the surgeon for his approval, and variety should be insisted on. It is the duty of the noncommissioned officer also to see that the meals are properly and promptly served in both the dining-room and wards.

Wastage must be carefully avoided, grease and drippings should be preserved for use in cooking, and bones for the preparation of

soup. In the dining-room the rule should be small portions served as desired rather than large portions to be left on the plate.

Different classes of diet are necessary in hospital because of the great variety in the nature and severity of the diseases treated therein. The arrangement of the diet tables is based upon our knowledge of the relative digestibility of the different sorts of food, and the part which the different portions of the digestive tract take in the process of digestion.

The diets usually found in military hospitals are *full, light, liquid,* and *special.*

Full diet includes what is served at the table in the dining-room; the other diets are ordinarily served in the wards.

Light diet includes liquids and the simpler and more digestible articles of solid or semisolid food. Each surgeon usually has his own diet list; the following table, which has been used at the U. S. Army General Hospital, Presidio of San Francisco, California, may be taken as an illustration of full and light diets.

In addition to the regular diet tables a special diet list is provided for the use of ward surgeons for cases requiring this kind of diet.

Liquid diet: This includes *liquids only,* such as milk, strained soups, gruels, broths, albumen water, etc. The amount of each of these articles to be taken by a patient in twenty-four hours should always be stated.

Special diet: This is usually a list from which special articles of food are prescribed for particular cases.

As to which diet shall be given to a particular patient depends upon the nature of the case. In all fevers and grave disorders, while there is increased necessity for food to repair the unusual waste, there is unfortunately also diminished power of digestion and assimilation.

Therefore we begin with liquid foods to save the digestive apparatus the labor of liquefying them, and we give them in small quantities and frequently.

If there is irritation of the stomach and bowels we give those foods which have the least indigestible residue to irritate the bowels. From liquids we go on to jellies, custards, ice cream, light puddings, milk toast, lightly boiled eggs, chicken, rare steak, etc.

FULL DIET

Breakfast.	Dinner.	Supper.
Sunday.		
Cereal and milk.	Vermicelli soup.	Veal stew or boiled ham.
Ham and eggs.	Roast veal, sage-dressing, or turkey, or chicken and dressing.	Apple sauce.
Bread and butter.	Stewed peas. Mashed potatoes.	Cake.
Fruit.	Farina pudding. Fruit.	Bread and butter.
Coffee.	Bread and butter, coffee.	Tea.
Monday.		
Cereal and milk.	Roast beef.	Codfish balls or hash.
Beefsteak.	Mashed potatoes. String beans.	Bread and butter.
Fried potatoes.	Tapioca pudding.	Pickles.
Bread and butter.	Bread and butter. Fruit.	Jam. Sweet crackers.
Fruit. Coffee.	Coffee.	Prunes. Tea.
Tuesday.	Vegetable soup.	Fried liver and bacon.
Cereal and milk.	Baked pork and beans.	Corn bread and syrup, or
Sausage.	Baked tomatoes.	Biscuits.
Fried potatoes.	Bread pudding.	Bread, butter, tea.
Bread and butter.	Bread, butter, cocoa, fruit.	Fruit.
Coffee. Fruit.		
Wednesday.		
Milk toast.	Roast mutton with dressing.	Mutton stew.
Beefsteak.	Mashed potatoes.	Pickles. Sweet crackers.
Bread and butter.	Corn or fresh vegetables.	Bread, butter, tea.
Coffee. Fruit.	Chocolate pudding, fruit.	Peach cobbler.
	Bread, butter, coffee.	
Thursday.		
Cereal and milk.	Oyster soup.	Sliced roast beef.
Hash.	Corned beef and cabbage.	Macaroni and cheese.
Bread and butter.	Boiled potatoes. Radishes.	Preserves.
Coffee. Fruit.	Rice pudding. Fruit.	Bread and butter.
	Bread, butter, coffee.	Tea.
Friday.		
Cereal and milk.	Baked fish with sauce.	Salmon salad. Potato salad.
Bacon and eggs.	Plain boiled potatoes.	Apple sauce.
Bread and butter.	Fresh salad.	Ginger crackers.
Coffee. Fruit.	Farina pudding. Fruit.	Bread and butter. Tea.
	Bread, butter, cocoa.	
Saturday.		
Cereal and milk.	Roast beef, veal, or pork.	Baked hash or stew.
Beefsteak.	Mashed potatoes.	Stewed prunes.
Fried potatoes.	Hot slaw. Cauliflower.	Assorted cakes.
Bread and butter.	Bread pudding.	Bread and butter.
Coffee. Fruit.	Bread, butter, coffee.	Tea.

LIGHT DIET

Breakfast.	Dinner.	Supper.
Sunday.		
Cereal and milk. Soft-boiled eggs. Milk toast. Coffee.	Rice soup. Farina pudding. Coffee.	Milk toast. Cup custard. Tea.
Monday.		
Cereal and milk. Milk toast. Boiled eggs. Coffee.	Plain tomato soup. Bread pudding with lemon sauce. Coffee.	Farina mush and milk. Sweet crackers. Jelly. Toast. Tea.
Tuesday.		
Cereal and milk. Boiled eggs. Coffee.	Barley soup. Tapioca pudding. Cocoa.	Biscuits or corn bread. Maple syrup. Boiled rice. Milk toast and tea.
Wednesday.		
Cereal and milk. Soft-boiled eggs. Coffee.	Consommé vermicelli. Cornstarch pudding. Vanilla sauce. Coffee.	Sweet crackers. Jam. Milk toast. Tea.
Thursday.		
Cereal and milk. Boiled eggs. Coffee.	Oyster soup. Rice pudding. Coffee.	Macaroni and cheese. Milk toast. Maple syrup. Tea.
Friday.		
Cereal and milk. Boiled eggs. Milk toast. Coffee.	Fish chowder. Farina pudding. Cocoa.	Tapioca pudding. Milk toast. Ginger crackers. Boiled eggs. Tea.
Saturday.		
Cereal and milk. Boiled eggs. Coffee.	Vermicelli soup. Sago pudding. Coffee.	Cereal mush. Assorted cakes. Jelly Milk toast. Tea.

CHAPTER II

COOKING

PRACTICAL cooking can only be learned in the kitchen where each hospital-corps man must serve an apprenticeship, those who show aptitude being given an opportunity to develop into cooks. But the principles of cooking and diet cooking must be learned by all.

Nearly all food is capable of prompt putrefaction; putrefaction is due to the growth of germs, and requires the presence of heat, moisture, and organic matter; if any one of these conditions is absent putrefaction will not take place. Hence meats will keep indefinitely when frozen (absence of a suitable temperature); when dried (absence of moisture); canned (absence of germs which have been destroyed by heat); or when pickled (absence of germs which have been killed by antiseptics, such as salt, vinegar, and sugar).

A clean kitchen means the practical absence of germs; in such a kitchen foods do not spoil or putrefy.

The following extracts from an old work on "Camp Fires and Camp Cooking" are worth repeating here:

"Cleanliness is net to godliness, both in person and kettles: Be ever industrious, then, in scouring your pots. Much elbow grease, a few ashes, and a little water are capital aids to the careful cook. Dirt and grease betray the poor cook and destroy the poor soldier, whilst health, content, and good cheer should ever reward him who does his duty and keeps his kettles clean. In military life, punctuality is not only a duty, but a necessity, and the cook should always endeavor to be exact in time. Be sparing with sugar and salt, as a deficiency can be better remedied than an overplus.

"Remember that beans, badly boiled, kill more than bullets; fat is more fatal than powder. In cooking, more than anything else in the world, always make haste slowly. One hour too much is vastly better than five minutes too little, with rare exceptions. A big fire scorches your soup, burns your face, and crisps your temper. Skim, simmer, and scour are the true secrets of good cooking."

Cooking improves the flavor of food and thereby increases the appetite; it destroys all parasites and disease germs; and it enables the food to be more thoroughly masticated and digested.

It lessens the toughness of muscular fibres, gelatinizes the connective tissue, coagulates albumin, breaks up the starch granules and practically converts them into glucose and dextrin, all of which permits of more thorough penetration of the digestive fluids and more rapid digestion.

The ordinary processes of cooking are *boiling, stewing, roasting, baking, frying,* and *broiling* or *grilling.*

In *boiling,* the object is to cook the food and at the same time retain in it all its natural juices. To do this with fresh meat and vegetables the water should be salted, and the food in large masses dropped at once in boiling water; this by coagulating the albumin in the outer layers forms a protecting coating which prevents the juices from escaping.

Active boiling is continued for five minutes, after which the process should be one of *simmering* or very slowly boiling.

Salt meats, beans, and pease should be put on in cold water and the temperature slowly raised.

Potatoes should be boiled in their jackets, but if peeled the water should be salted to prevent the escape of the vegetable salts.

Fish and potatoes should be thoroughly drained after boiling. Beans, pease, rice, and other hard grains require a preliminary soaking; the two former can not be cooked in hard water. Fresh meats require about fifteen minutes to the pound.

In *stewing* meats we do not mind the escape of the juices because the *broth,* as the water in which meat is boiled is called, forms a part of the food, all of which is to be eaten. Therefore the meat is cut in small pieces, placed in cold water, and the boiling done very slowly; vegetables are usually added. If the stew is made with meat which has already been cooked it is known as a *hash.*

In *soup making* the broth is the part used, hence we desire to get out of the meat and bones and into the water all that can be extracted of their nutritive ingredients, and especially the gelatin which is a result of a prolonged boiling of the bone and connective tissues. The meat is cut in small pieces and the bones thoroughly cracked, and all placed in cold water in a covered pot which should simmer slowly and be frequently skimmed. The product when finished constitutes

stock, and the various soups are prepared by adding vegetables cut into small pieces, and cooking for an hour or so more or until the vegetables are done. Soup stock should not be kept in an iron pot because the iron gives it an unpleasant flavor.

In making *meat teas* or *extracts* by heat, the process is a little different from soup making; we do not wish any fat, hence lean meat is selected without bone, and all fat is removed after the broth is cold; the water should never come to a boil so as not to coagulate the albumin which we wish to retain.

Roasting is properly done in front of a clear fire with special arrangements for concentrating the heat and turning the joint. In this country the term *roast* is ordinarily applied to *baked meats.*

Baking is done in an oven, and as the fat acids developed by high temperature can not escape, the flavor and digestibility are not so good as in roasting. As in boiling, our object is to expose the roast to a high temperature in order to coagulate the surface layer so that it may retain the juices; when that is accomplished the balance of the cooking is done more slowly at a lower temperature. Frequent *basting* with the melted fat and meat juices is necessary in order to prevent the surface becoming too tough and hard, and to secure better penetration of the heat into the interior of the joint. The oven must not be too hot; if the hand and arm can be held in the oven for fifteen seconds the temperature is about right. Baking ordinarily requires about fifteen minutes to the pound.

Broiling or *grilling* is practically the same as roasting only the cooking is done over instead of in front of the fire, and a larger extent of surface is exposed to the heat.

The meat is placed on a gridiron or broiler over a clear bright fire free from smoke. If the broiling is done before a fire instead of over it, the juices can be caught in a drip pan and used.

Frying is properly done by dropping the meat or vegetables in boiling oil or fat at a temperature of about 500° F. and in a frying pan deep enough to immerse the article to be cooked. If the fat is hot enough the surface layer of the meat is at once coagulated as in boiling and roasting, and the grease does not penetrate.

Frying is usually improperly done, the bottom of the frying pan being only greased enough to prevent the meat from sticking to it; articles thus fried are saturated with grease and indigestible.

The object of *bread making* is to convert an indigestible, tasteless

mass of flour into an appetizing, porous food capable of ready penetration by the digestive juices and known as *bread*.

The first step is to make the *dough*, which is done by thoroughly mixing or *kneading* the flour with salt and water; the next step is to impart the necessary porosity by the introduction of carbonic-acid gas into the mass; this is done by either generating it within the dough or forcing it in from without.

The first of the methods may be effected either by fermentation of *yeast* or by *baking powders;* the second constitutes the so-called *aerated bread*, a process little used in this country.

The carbonic-acid gas is held in minute bubbles by the tenacity of the *gluten*, the nitrogenous element of flour, and the dough *rises*, becoming light and spongy. It is then kneaded over again, divided into loaves of suitable size, allowed to rise for about one hour in the forms, and then baked, by which the gas is still further expanded, the dough made lighter, and the porosity permanently fixed in the *bread*.

By *leavened bread* we mean that which has been made by fermentation; yeast may be used directly, or we may use a portion of old fermenting dough or leaven; the former is preferable.

In the growth of the yeast fungus a portion of the sugar of the dough is converted into alcohol and carbonic acid; the former is driven off by the heat in baking, and the latter is spread through the dough, making it porous. Usually a portion of the flour is first made into dough with yeast, salt, and water, and set aside in a warm place for a couple of hours, this constituting the *sponge* which is subsequently thoroughly kneaded with the remainder of the flour and water, and the fermentation allowed to proceed in the entire mass.

The important point is to know just when it has gone far enough; if it goes too far the bread becomes *sour;* if not far enough it is *heavy*.

The necessary carbonic acid may also be generated by the use of *baking powders;* these consist generally of bicarbonate of soda mixed with cream of tartar, acid phosphate of lime, or alum; in the chemical reaction which takes place in the dough carbonic-acid gas is set free and certain more or less harmless salts remain in the bread. Alum baking powders are objectionable because the remaining salts are believed to cause indigestion.

CHAPTER III

RECIPES

THE following recipes are taken from the valuable pamphlet on "Emergency Diet for the Sick in the Military Service," by Captain Edward L. Munson, assistant surgeon, U. S. Army, and published with his permission. They will serve an excellent purpose in preparing foods for the sick and also in the instruction of the hospital corps in cooking and diet cooking:

LIQUID DIET

Sterilized Milk

Pour the milk into a granite saucepan (or a double boiler) and raise the temperature of milk to about 190° Fahrenheit. Keep it at this point for one hour. Do not boil the milk. Any utensil used for this purpose must be absolutely clean.

Milk Punch

Three-fourths of a coffee cup of milk (six ounces)
Two tablespoonfuls of brandy or whisky.
One teaspoonful of sugar.
Grated nutmeg to taste.

Sweeten the milk (preferably sterilized) with the sugar. Stir into it the brandy. Shake it up well by pouring from one cup into another, or by the use of a milk-shaker, until a froth is formed. Grate a little nutmeg on top and serve.

The term "cup" in this recipe, as in all others, means the ordinary coffee cup, holding eight ounces.

Milk with Mineral or Aerated Waters

Mix equal quantities of sterilized milk with seltzer, soda water, or lime water, and serve immediately.

Albumenized Milk

Beat up the white of an egg till light. Add a good-size pinch of salt, and four ounces of fresh, cool milk which has been sterilized. A little sugar may be added if desired.

Peptonized Milk (Cold Process)

Into a clean quart bottle put two peptonizing tablets dissolved in four ounces of cold water. Add one pint of fresh cold milk, shake thoroughly, and place the bottle on ice. Use clean cotton to plug the bottle.

In place of the peptonizing tablets, five grains of pancreatine and fifteen grains of sodium bicarbonate, to be obtained from the dispensary, may be employed.

Peptonized Milk (Warm Process)

Into a clean quart jar or bottle put the tablets above mentioned, dissolved in four ounces of cold water. Add one pint of fresh milk and shake the whole well. Place the bottle in a pan or kettle of hot water maintained at such a temperature that the hand can just be held in it without discomfort. Keep the bottle in the water for ten minutes. Put on the ice immediately after removing from the hot bath, to check further digestion. If ice is not available pour the milk into a saucepan and heat quickly to boiling.

Whey

Warm one pint of milk to about blood heat, or about 100° Fahrenheit. Dissolve half a rennet tablet in one tablespoonful of cold water. Stir it into the milk and let it stand until the latter is curdled, which will be in a few minutes. Break up the curd with a fork and strain off the liquid (whey). This may be sweetened with sugar, and when cooled makes a refreshing drink for fever patient.

Junket

Heat one pint of fresh unboiled milk to about blood heat, or about 100° Fahrenheit. Dissolve a full tablespoonful of sugar in it. Add half a rennet tablet which has been dissolved in one tablespoonful of cold water. It will set the milk in about fifteen minutes. Put in a cool place till ready to be used. It can be served plain, or with cream, sugar, and a little nutmeg.

Farina Gruel

One tablespoonful of farina.
One pint of water.
One teaspoonful of sugar.
One-half teaspoonful of salt.

Into one pint of water, raised to boiling, put a half teaspoonful of salt; then add the farina and cook for twenty minutes. Flavor with sugar and condensed milk, if fresh milk is not available. Strain and serve hot.

In this recipe, as in others, condensed milk is used in a strength of one teaspoonful to the half pint of gruel.

Rice Gruel

Two tablespoonfuls of rice.
Or one tablespoonful of rice flour
One pint of boiling water.
One-half teaspoonful of salt.
One teaspoonful of sugar.

Wash the rice thoroughly in two waters, after removing any specks that may be mixed in the grain. Have the cooking water boiling. Add the salt and then the rice. Boil for two hours, when the rice should be almost entirely dissolved. Strain. Add condensed milk and sugar, if desired. Some persons prefer the use of salt alone.

If ground rice or rice flour is used, it should be mixed with cold water before mixing with boiling water, and requires but thirty minutes' boiling. Flavor with sugar or condensed milk.

Hard-Bread Gruel

Toast hard bread thoroughly and grind it into a powder. To one pint of boiling water, to which one-half teaspoonful of salt has been added, add two tablespoonfuls of hard-bread powder. Boil ten minutes and then strain. Flavor with one teaspoonful of sugar and one teaspoonful of condensed milk to each cupful of the gruel.

Koumyss

Dissolve one-fourth cake of compressed yeast (Fleischmann's) in a little warm water. If Fleischmann's yeast is not obtainable, use one-fourth cake of ordinary compressed yeast or half a fluid ounce of bakers' yeast. Warm one quart of fresh milk to about 90° Fahrenheit, add one tablespoonful of sugar and the dissolved yeast; thoroughly mix and put into a stout bottle, tying a small piece of cloth firmly over the cork to hold it in place. Shake well, and allow to stand for six hours at a temperature of about 70° Fahrenheit. Then put the bottle on ice upside down, and allow to stand for three days before using. Condensed milk may be used with as good a result as fresh milk. Use five parts of water to one part of condensed milk, and omit the sugar.

Lemonade

One small lemon or lime.

One tablespoonful of sugar.

Three-fourths of a coffee cup of water (six ounces).

Wash and wipe the lemon or lime. Squeeze the juice into a glass or bow.. Then add the sugar, pour on the water, and strain. Serve at once. Boiled or sterilized water should be used.

Orangeade

One orange.

One teaspoonful of sugar.

Three-fourths of a coffee cup of water (six ounces).

Wash and wipe the orange. Squeeze the juice into the sugar. Add the cold water, previously boiled. Strain and serve.

Eggnog

One egg.

Two teaspoonfuls of sugar.

Three-fourts of a coffee cup of milk (six ounces)

Salt to taste.

Beat the egg up till light. Add sugar and salt and then the milk, which is better when not too cold. With the addition of one or two tablespoonfuls of brandy this makes a very strengthening drink for convalescents.

Egg Lemonade

One egg.
One small lemon.
Two teaspoonfuls of sugar.

Beat up the white and yolk of the egg separately; add sugar to yolk. When both are light, mix them together and add the strained juice of the lemon. Pour into a glass and serve with a spoon.

A little cold water may be added if the beaten egg is too foamy.

Sherry and Egg

One egg.
One teaspoonful of sugar.
Two tablespoonfuls of sherry wine.

Break the egg into a bowl and add the sugar. Beat the two together until they are thoroughly mixed. Add two tablespoonfuls of sherry wine and an equal quantity of cold water. Mix thoroughly, strain, and serve immediately.

Toast Water

Toast three slices of soft bread till very brown, and dry throughout. Break up fine, add one pint of boiling water, and set aside for fifteen minutes. Turn into a strainer or piece of gauze and strain. The water thus obtained may be used plain, or a little sugar or condensed milk may be added. It may be served either hot or cold.

Coffee

To each cup of water allow one tablespoonful of coffee, freshly roasted and ground. Have the water boiling. Mix the coffee with a little cold water and pour it into the boiling water. Let the whole come to a boil, and then set aside for five or ten minutes to steep and settle before using If muddy it may be cleared by boiling with egg shells, or, in their absence, by a dash of cold water. Add sugar and fresh or condensed milk to flavor as desired.

Tea

To each half-pint of boiling water add one teaspoonful of tea. Let it steep or infuse for five minutes. Never let tea boil. Add sugar and fresh or condensed milk to flavor as desired.

Beef Juice

Cut a lean piece of steak, from the round or other good portion, about one-half pound in weight. Remove all fat and fibrous tissue. Broil over a clear, hot fire so that the meat becomes pink and full of juice. It should

not be merely done on the outside and raw inside. Cut into small pieces and squeeze out the juice. Add a little salt and it is ready to serve.

If it is needed warm, place the cup holding the juice in a bowl of warm water. Do not let the temperature of this water exceed 160° Fahrenheit.

Beef Juice (Bottled)

Choose a good, well-flavored piece of beef, half a pound in weight. Cut away the fat, leaving only the lean. Cut this up into small pieces. Put these into a clean glass jar and cover the latter. Set the jar in a deep saucepan of cold water and heat gradually for one hour. Then strain out the juice and press the meat. Add a little salt and serve.

If the temperature of the water exceeds 160° Fahrenheit the beef juice becomes brown and flaky. A half-pound of beef should give from three to four tablespoonfuls of juice.

Beef Tea (Bottled)

Select and prepare the beef as for bottled beef juice, except that to each half-pound of meat a cup of cold water should be added, pouring the water over the beef after it has been put in the jar. The liquid thus obtained will resemble the beef juice in every respect except strength. Add a little salt and serve.

Beef Tea with Hydrochloric Acid

Select and prepare the beef as above. Put into a bowl and pour over it one cupful of cold water, to which five drops of dilute hydrochloric acid have been added. Let the whole stand for two hours in a cool place. Strain, add salt to flavor, and serve cold. This tea may be heated; but the albumin which coagulates and appears as brown flakes should not be strained out, for it is the nutritious portion of the tea.

Beef (or Mutton) Broth

One pound of lean beef (or mutton).

One quart of water.

One teaspoonful of salt.

Soak the meat, previously chopped fine, in the cold salted water for at least two hours, in the vessel in which it is to be cooked, keeping it on ice or in a cool place during this time. Then expose to moderate heat. Keep the vessel covered and allow the broth to simmer, keeping up the original quantity of water, for three hours at least. Let it cool overnight, skim off the fat in the morning, and keep covered in a cool place until needed. Heat and serve as required.

Chicken Broth

Fowls are better to use for broth than young chickens. Pluck and prepare by singeing with a blazing newspaper, straw, or dry grass. Remove all refuse — entrails, oil bag, crop, lungs, etc. Wash well in cold water, then cut up and disjoint. To each pound of chicken add a quart of cold salted water and simmer for two hours; then boil for two hours. Add rice or powedered hard bread or soft bread crumbs in the proportion of one table-

spoonful to each quart of water. Vegetables, such as onions, garlic, carrots, celery, and parsley, may be also used, a tablespoonful to the quart, and should be put in when the broth is first put on to cook. Strain, remove the fat, and serve hot.

Canned Soups

To render canned soups ready for eating, simply raise them to the boiling point by immersing the cans in boiling water for half an hour to thoroughly heat the contents; or empty and heat the contents in a granite saucepan. After diluting with the proper amount of water, following directions on the cans, they are ready to serve. Before heating any canned article a hole should be punctured in the upper end of the can.

Clam broth (Canned)

This may be served hot or cold. If the broth is desired plain, add an equal quantity of water to the clam juice and heat to the temperature required. Do not boil. Clam broth can also be given iced. If fresh milk is available, equal parts of milk and clam juice may be heated up together.

SEMISOLID OR LIGHT DIET

Poached Eggs

Pour sufficient boiling water into a clean cooking untensil and add salt in the proportion of one teaspoonful to the quart of water. Place it on the stove to boil. Break a fresh egg into a small dish, and when the water boils slide the egg gently into it. When the albumen or while is firm, or at the end of two minutes, lift the egg out of the water with a skimmer and place it on a piece of hot, nicely-browned toast or hard-tack. Sprinkle with a little salt and pepper and serve hot.

Soft Cooked Eggs

Put into a saucepan as many eggs as are to be cooked. Pour over them water enough to cover. The water should have been brought up not quite to the boiling point. Let the eggs stay in the water from seven to ten minutes, and the result is an evenly cooked egg throughout. When the water is poured on the eggs do not set the pan on the fire. No further heating is required, but the water should not be allowed to cool down too rapidly.

Omelet

Two eggs.

Two tablespoonfuls of milk, cream, or water.

One-fourth teaspoonful of salt.

Pepper to taste.

Beat up the yolks and whites of the eggs separately. Add the salt to the yolks. Mix the whites and yolks together with the milk, cream, or

water. Place a small piece of butter or bacon fat in a pan or plate hot enough to melt it. Pour in the omelet, and with a sharp knife loosen the edges as they solidify and fold over the omelet into a half-circle. When done, turn out on a plate and serve hot. When milk can not be had, water may be used.

Spanish omelet has minced onion added to the above. An excellent addition to the plain omelet is a dressing made of canned tomatoes and boiled crumbled hard bread, strained, seasoned, and heated together. Never use flour in an omelet, as it can not be cooked sufficiently in the short time that should be given to eggs.

Baked Custard

One pint of fresh milk.
Two eggs.
One-third teaspoonful of salt.
Two tablespoonfuls of sugar.
Small piece of cinnamon.

Put the cinnamon in the milk and pour into a saucepan to heat. Break the eggs into a bowl with the sugar and salt, and beat until well mixed but not light. When the milk comes to a boil pour it over the eggs. Stir slowly to dissolve the sugar. Strain the mixture into cups, set them in a deep pan of boiling water, and bake for twenty minutes in a moderately hot oven.

Dry Toast

Cut the bread in slices one-thrid of an inch in thickness. Toast may be made either by drying bread in an oven and then placing on a toaster over the fire, or the bread may be allowed to dry and brown in the oven. Toast that is moist and soft in the middle should never be given to an invalid. Have it dry, crisp throughout, and of a golden-brown color. Serve hot, either dry or buttered.

Milk Toast

Put a cup of milk into a saucepan and let it heat to the boiling point. Have ready three slices of nicely browned bread. Put a little salt in the milk and pour it over the toast. A little butter may be spread on the latter, but it is a more delicate dish without it. Serve hot.

Oatmeal Porridge

Three tablespoonfuls of oatmeal or rolled oats.
One pint of boiling water.
One-fourth teaspoonful of salt.

Dissolve the salt in the water, then add the oatmeal. Cook for two hours in a double boiler. Rolled oats require cooking only half an hour. Oatmeal is very appetizing when served cold in mold shapes, and it will frequently be eaten in this way when it would be refused if served in any other form. Variations may be made by using farina, browned rice (browned in the

oven before steaming and molding), arrowroot, etc., giving further change by serving occasionally with sweetened fruit juices, fresh, dried, or canned, instead of cream or milk.

Farina Mush or Porridge

hree tablespoonfuls of farina
One pint of boiling water.
One-half teaspoonful of salt.

The water must be boiling before putting in the farina. Boil for half an hour. It may be served with fresh milk, or condensed milk diluted one to four parts of boiling water, or with stewed dried fruit, such as prunes, peaches, or apples. Cold farina mush may be sliced and fried for the use of convalescents.

Plain Boiled Rice

One-half cup of rice.
Two cups of boiling water.
One-half teaspoonful of salt.

Pick the rice clean. Wash thoroughly in two waters, pouring off the last when ready to put the rice into the boiling water. Add the salt to the water. Pour in the rice and boil steadily for half an hour. In order to see if the rice is done, take out some of the grains and crush between the fingers. If done, they will mash easily and feel perfectly soft. Do not stir the rice, as this will cause it to fall to the bottom and burn. Serve with sugar and fresh or condensed milk or with stewed fruits.

Steamed Rice

Wash the rice thoroughly in two waters. Use in same proportions as are given for boiled rice. Use a double boiler. Have the water boiling in lower boiler. Place the above mixture of rice, boiling water, and salt in the upper chamber, and let cook for one hour. Do not stir. Keep the rice covered while steaming, and keep the lower boiler well supplied with boiling water. Serve as with boiled rice.

Milk Porridge

The flour for milk porridge should be prepared in the following manner: Tie up in a muslin bag or towel as much flour as desired and boil for four or five hours, then bake in an oven until dry. To make the porridge, grate two tablespoonfuls of the dried flour, mix it with cold water into a paste, and add to it one pint of boiling milk or boiling water. Boil for ten minutes. If water alone is used to make the porridge, condensed or fresh milk may be used in addition, in equal parts or diluted one-half with water.

Condensed milk used in this recipe is made in the strength of one part of condensed mlk to four of water. Salt is added in proportion of one teaspoonful to the quart of boiling milk or water.

Lemon Jelly

One-fourth box of gelatin (one-half ounce).

One-fourth cup of cold water.

One-fourth cup of fresh lemon juice (about the amount yielded by two lemons).

Three tablespoonfuls of sugar.

One and one-fourth cups of boiling water.

Put the gelatin to soak in the cold water, about twenty minutes being required for this process. When dissolved, pour on the boiling water. Add the lemon juice and sugar. Stir thoroughly and strain through a fine-meshed cloth into a china or granite-ware mold, cooling in a refrigerator or by placing in a pan of cold water. Never use tin molds for lemon jelly.

Coffee Jelly

One-fourth box of gelatin (one-half ounce).

One-fourth cup of cold water.

One cup of boiling water.

One-half cup of strong coffee.

Two tablespoonfuls of sugar.

Soak the gelatin in the cold water for half an hour. Pour on the boiling water, then put in the sugar and coffee. Strain it through a cloth into a mold or dish in which it may be cooled, either in a pan of iced water or in a refrigerator. Coffee jelly may be served with cream and sugar.

Have the coffee strong, two tablespoonfuls of coffee to each cup of water. Where vanilla extract is available, one-half teaspoonful will be advantageously added to the above recipe.

Wine Jelly

One-fourth box of gelatin (one-half ounce).

One-fourth cup of cold water.

One-half cup of sugar.

One-half cup of sherry wine.

One and one-fourth cups of boiling water.

One small piece of cinnamon.

Put the gelatin and cold water together in a dish large enough to hold the whole mixture. Let it soak for half an hour, then pour the boiling water (in which the piece of cinnamon has been simmering) over the softened gelatin. Add the sugar and wine, strain through a clean cloth into a china or granite-ware mold, and cool in a refrigerator or a pan of cold water.

Stewed Dried Apples, Apricots, or Peaches

Wash the fruit thoroughly. Soak for four or five hours in the cold water it is to be cooked in, using only a sufficient quantity of water to cover. Heat in a covered granite-ware saucepan, simmering slowly for two hours. Do not boil. If the fruit is allowed to simmer it will not burn or need stirring, which breaks it up and makes it look unsightly. Apricots need plenty of sugar, but this should not be added until five minutes before taking off the

fire. Lemon juice or lemon peel may be added to poorly flavored apples, a tablespoonful of the juice or the peel of half a lemon to the pound of fruit, or spices may be used for flavoring. The use of brown sugar in stewing dried fruit is to be preferred, because of the better flavor which it gives.

Baked Apples

Select fair, sound, and preferably tart apples. Wash and wipe them and cut out the cores, removing all the seeds and husks. Cut off any dark spots on the outside. Put the prepared apples into a granite or earthernware dish. Put into each apple from one-half to one teaspoonful of sugar, according to the acidity of the fruit, and a bit of lemon peel. Pour boiling water into the dish about one-fourth inch deep, and bake in a moderately hot oven. When perfectly soft all through, the fruit is done. The time for baking varies, according to the species of apple, from half an hour to two hours.

Canned Fruit, Serving of

Remove from cans several hours before using and put in porcelain or granite-ware dish to cool. Canned fruit is much improved by cooling, being more palatable and refreshing than if served direct from the can. Never allow fruit to remain in cans when once opened. This applies particularly to very acid fruit, and also to meats, fish, or vegetables.

Baked Potatoes

Have the potatoes of a uniform size, so that all may be done at the same time. Wash them thoroughly and bake in a hot oven from forty-five to fifty minutes. They are recognized as being done by the soft, yielding sensation given on pinching.

oasted Potatoes

Bury under the hot ashes of an open fire (camp) for half an hour or more. The thoroughness of cooking is recognized as with baked potatoes. Break open by squeezing. Brush the ashes off first.

Boiled Potatoes

Wash the potatoes well. Pare carefully so as not to waste. Put them on to cook in boiling salted water, enough to cover, and let boil for thirty minutes. It requires more time for large-size potatoes. When easily pierced with a fork they are done. Drain off the water, and dry them on top of the stove by moving the boiler back and forth for a minute or two. Serve as quickly as possible after they are cooked.

Mashed Potatoes

Prepare as for boiled potatoes. When cooked, drain off the water and mash in the dish in which they were boiled. Add butter, pepper, and salt to taste, and lastly put in a little milk or cream. Whip up lightly and serve immediately. Keep the dish covered until served.

Scraped Beef

Cut a piece of steak from the round, about half a pound in weight and about an inch thick. Lay it on a clean meat-board and with a dull knife scrape out the pulp until there is nothing left but stringy fiber. Season the scaped pulp with salt and make it into small cakes. Broil for two minutes either by direct heat over a clear fire, or by heating a clean pan or plate and, when hot, placing the meat on it. Have both sides cooked sufficiently. This is a safe food for a patient beginning to take solid nourishment. Scraped beef may be prepared very easily over an alcohol lamp.

Scraped Beef Sandwiches

Place a piece of round steak on a meat-board and scrape out all of the pulp with a dull knife; add to the pulp a little salt and pepper and enough raw beef juice to make it into a firm jelly. Have stale bread cut into very thin slices and spread the beef pulp on them; cut the sandwiches quite small. Never use butter in making beef sandwiches.

Broiled Beefsteak

Have a clear, hot fire, either coal or charcoal. Put the steak on a broiler, place directly over the fire for about a minute, then turn and do the same with other side. By applying greater heat at the outset the juices are kept in the meat. It requires from five to seven minutes over a clear fire to broil a steak an inch thick. Season both sides with salt and a little pepper, but no butter. Serve hot. A baked potato is a good vegetable to serve with the above, as is also boiled rice.

Another good way to broil steak is to heat a granite-ware plate on a stove till it is quite hot. Place the steak on it till one side is done, then turn it and do the same with other side.

Stewed Chicken

Boil a chicken, prepared as for broth, until tender. Set it away till it is cool. Skim off the fat; take the meat and cut it up in cubes or small pieces, rejecting all skin, gristle, tendons, and bones. To one cupful of the meat add one pint of the broth, seasoning with salt and pepper. Mix one teaspoonful of flour with a little cold water, blend it thoroughly, and add it to the chicken. Let the whole stew for ten minutes, and serve with toast or boiled rice.

Minced Chicken on Toast

Prepare the chicken as for broth. When cool, skim off the fat and mince up the meat fine, rejecting all skin, tendons, gristle, and bone. Season with salt and a little pepper. Add enough broth, or better yet, cream, if available, to make it of the proper consistency, or about that of cream. Have ready some nicely-browned dry toast, pour the minced chicken over it, and serve hot.

THE HOSPITAL STORES

Beef Extract (Liquid)

To four ounces of cold, sterilized water add half a teaspoonful to one teaspoonful of the liquid extract. Mix thoroughly; season with salt and pepper to taste, and, if obtainable, with celery salt.

Where a hot beef tea is required the above preparation may be heated, care being taken not to remove the nutritious curdy flakes produced by boiling.

Malted Milk

Mix one or two tablespoonfuls of malted milk with a like quantity of warm, boiled water. Add more water to make up half a pint. Season with salt to taste.

Boiling water can not be used to advantage in making up this preparation.

Chocolate

Grate one ounce of chocolate. Have ready one pint of boiling milk. Mix the grated chocolate with some hot milk into a paste, add to it the boiling milk and boil five or six minutes. Flavor with sugar, one teaspoonful to the pint. The chocolate issued in the hospital stores is partly sweetened. If unsweetened chocolate is used, a tablespoonful of sugar is required. If fresh milk is not available, make the chocolate with boiling water and add one teaspoonful of condensed milk to each half pint of chocolate.

Arrowroot Blanc-Mange

Two tablespoonfuls of arrowroot.

Two-thirds pint of hot water.

Two tablespoonfuls of sherry or brandy.

Two teaspoonfuls of sugar.

Mix the arrowroot into a smooth paste with three tablespoonfuls of cold water. Add this to the hot water. Bring to a boil, stirring constantly till well blended and free from lumps. Let boil for ten minutes. Add the sugar and sherry or brandy. Beat up quickly and pour into a bowl or mold to cool. Arrowroot blanc-mange may be made with fresh hot milk or condensed milk diluted. If boiling water is used it causes the starch of the arrowroot, when first poured in, to form into lumps. Hence it is best to have the water not quite at boiling point.

THE RATIONS

Hard-Bread Toast Water

Two tablespoonfuls of powdered hard bread.

One pint of boiling water.

One-half teaspoonful of salt.

Add the powdered hard bread, after toasting or parching in an oven, to the salted boiling water. Boil for ten minutes. Strain through gauze and serve hot or cold. The toast water may be flavored with sugar, condensed milk, or whisky.

Hard-Bread Mush or Porridge

One cup of powdered hard bread.
Four cups of boiling water.
One teaspoonful of salt

Mix and boil for ten minutes. The resulting mush may be eaten with condensed milk or stewed dried fruit.

Care should be taken to prevent scorching by frequent stirring, and the water should be boiling in all cases before adding the powdered bread.

Hard Bread as Milk Toast

Toast two or three pieces of hard bread to a good brown color by placing in an oven or over a clear fire on a toaster. When done, pour enough boiling water over them to soften thoroughly. Dilute two tablespoonfuls of condensed milk in four times as much boiling water. Drain off the water from the toasted bread and pour on the milk. Serve hot.

Hard Bread and Dried Apples (Brown Betty)

Soak the dried apples for at least four hours. Grease a baking pan or dish and place in it first a layer of sliced apples, then a layer of hard-bread crumbs, or whole hard bread softened in boiling water for ten minutes, with small quantities of butter or fat pork and sugar, and a little ground cinnamon sprinkled over each layer. Continue till the dish is full, having bread crumbs for the top layer. Moisten with a cup of water, or fresh or diluted condensed milk, and bake three-quarters of an hour in a moderately heated oven. When a fork easily pierces the apples the pudding is cooked. It can be eaten hot or cold with butter and sugar worked up together and flavored with cinnamon or nutmeg; with a simple sirup of sugar and water, or with the following sauce:

Sauce for Hard-Bread Pudding

One pint of boiling water.
One tablespoonful of flour.
One-half cup of sugar.
One lemon.

To the water add the flour, mixed into a paste with three tablespoonfuls of cold water. Boil for ten minutes. Add the sugar and lemon juice, strained; or other flavoring to taste.

Bacon, Broiled

Wash in cold water. Cut into thin slices and broil over clear coals, either on a broiler or with a fork. Serve immediately.

Bacon, Fried

Cut into thin slices after washing, roll in hard-bread crumbs, and fry in a very hot pan which has been greased. Season with pepper and serve immediately. The bacon may be fried without the bread crumbs if preferred.

Bacon, Boiled

Wash the bacon in cold water. Scrape and trim off any rusty or brownish spots, and, if very hard or dry, soak for a few hours in cold water. Put it on to cook in enough cold water to cover it well, let it come slowly to a boil, and then boil steadily until done. As the water evaporates or boils away, replenish it with more boiling water. When the bacon can be easily pierced with a fork in the thickest part, it is sufficiently cooked. Save the fat, it will be useful in frying; and if greens are to be cooked, leave enough in the water to season them.

Canned Roast Beef Soup

One pound (one-half can) of roast beef.
One pint of cold water.
Salt and pepper to taste.

Cut the beef into small pieces and add it to the cold water. Let the whole come to a boil and then simmer gently for half an hour. Skim off the fat and strain, taking care to express all the meat juice and gelatin from the meat. Season with salt and pepper to taste. A little beef extract, when added to the above, improves the value and palatability of this soup. A tablespoonful of hard bread, powdered, may be added if rice and other grains are not available.

Canned Roast Beef Stew

Two pounds of canned roast beef.
Six small potatoes.
One onion.
Salt and pepper to taste.

Wash, peel, and slice the vegetables. Cover them with sufficient boiling salted water. Put them on to boil, and when nearly done add the roast beef, well cut up. Season to taste with pepper and salt, and let the whole simmer ten or fifteen minutes before serving. If potatoes are not to be had, hard bread, crumbled and softened in boiling water, may be used with the meat. Canned tomatoes, in varying proportions, make a good addition to the stew, as already described. In the absence of any other vegetables, they may be added to the meat in the proportion of pound for pound.

Canned Roast Beef Hash

Two pounds of canned roast beef.
Six boiled potatoes, small.
One onion.
Pepper and salt to taste.

Chop up the meat and vegetables thoroughly. Mix well. Season with pepper and salt and brown in a hot dish or frying pan, previously greased with pork or bacon, in an oven or over the fire. When potatoes cannot be obtained, a very good hash may be made by the use of softened hard bread or boiled rice in their place.

Canned Salt Beef Stew

Cut up the contents of a two-pound can. Cover with cold water and bring to the boiling point. Then add vegetables as directed for roast-beef stew. Season with pepper, but add no salt. Stew for three-quarters of an hour.

Canned Salt Beef Hash

Two pounds (one can) of salt beef.
One cup of hard-bread crumbs.
One onion.
Bacon fat or beef fat (about the size of an egg).
Water, or soup stock.
Pepper and salt.

Chop up the beef. Add the bacon fat or beef fat, and add sufficient water or soup stock to moisten the whole. Season with pepper and a very little salt. Parboil the onion, chop it up, and add it to the mixture. Put into a frying pan or mess plate and brown on both sides. If desired, the onion may be fried before adding it to the hash.

Rice Pudding

Two tablespoonfuls of rice.
One tablespoonful of sugar.
One pint of fresh milk.
Nutmeg or cinnamon as flavoring.

Wash the rice and cover with the milk, previously sweetened and flavored. Set in a moderately hot oven. Stir every fifteen minutes during the first hour and then once at the expiration of the next half-hour. Bake two hours and until the brown top forms. This gives a creamy, slightly brown pudding.

Baked Bean Soup

Take cold baked beans, add twice as much water as beans, and let them simmer till soft. When done, add half as much canned tomatoes and strain. If too thick add more water. Season to taste with salt and pepper.

Pea-Meal Soup

One-half pound of salt pork or bacon.
One and one-half pints of water.
Two tablespoonfuls of pea-meal.

Boil the bacon or pork in the water. When the meat is nearly cooked, add the pea-meal and let simmer until the meat is thoroughly done. Skim off the fat, season with pepper and serve. Canned salt meat can also be used to make pea soup, but does not require so long to prepare, as the meat is already cooked. Season with pepper and very little salt. Serve hot.

Fried Pea-Meal Mush

One pint of water.

One teaspoonful of salt.

Four tablespoonfuls of pea meal.

Add the pea-meal to the salted water. Boil for twenty minutes. Cool by pouring out into a plate or mess tin. Slice and fry quickly in hot bacon-fat (for convalescents).

Tomato Soup

To one can of tomatoes add an equal quantity of water and let simmer for half an hour. Mix one tablespoonful of flour with an equal quantity of beef dripping or bacon fat. Add it to the tomatoes. Season with pepper and salt. If very acid, a teaspoonful of sugar may be added to disguise the acidity. Boiled rice or hard-bread crumbs make a very good addition to tomato soup. Serve hot.

Stewed Tomatoes with Hard Bread

To each can of tomatoes add half an onion chopped fine, salt and pepper to taste, and if tomatoes are very acid, enough sugar to counteract the acidity. Cover, and stew for three-quarters of an hour. Hard-bread crumbs are added to thicken to the consistency desired.

Baked Tomatoes with Hard Bread

Mix enough hard-bread crumbs with the canned tomatoes to absorb the greater portion of the juice; season with salt, pepper, and thin slices of bacon laid on top, and bake from three-quarters of an hour to an hour. Onions, either raw or fried, may be chopped up and added to the seasoning.

APPROXIMATE MEASURES

Four teaspoonfuls of liquid are equal to one tablespoonful.

Three teaspoonfuls of solid material, as sugar or arrowroot, are equal to one tablespoonful.

One tablespoon contains one-half a fluid ounce.

One coffee cup, quartermaster's, contains ten fluid ounces.

One coffee cup, usual size, contains eight fluid ounces.

One glass tumbler, usual size, contains eight fluid ounces.

Two coffee cups, or glass tumblers, usual size, are equal to one pint.

One tin cup, soldier's field mess outfit, contains one and one-half pints.

PART VI

MATERIA MEDICA AND THERAPEUTICS, AND PHARMACY

CHAPTER I

MATERIA MEDICA AND THERAPEUTICS

Materia medica treats of the materials or drugs used in medicine; their origin, composition, physical and chemical properties, and their action.

Therapeutics is the art of applying the articles of the materia medica to the cure of disease.

Pharmacy is the art of preparing drugs and dispensing them.

MATERIA MEDICA

Drugs or medicines are derived from the animal, vegetable, and mineral kingdoms.

The *active principles* of drugs are those constituents which are *active* in producing the effects of the drug; morphine, for example, is the active principle of opium.

Among active principles are *alkaloids* and *neutral principles.*

Alkaloids are usually very insoluble in water, but combine with acids to form soluble salts; they have powerful medicinal effects; their Latin names end in *ina* and their English names in *ine;* morphine, atropine, and quinine are some of the alkaloids of the supply table.

Neutral principles are neutral in character; they are distinguished by having their Latin names ending in *inum* and English names ending in *in.* Among neutral principles of the supply table is santonin.

Organic acids are found in organic substances. Examples: acetic acid, citric acid.

Mineral acids are obtained from the mineral kingdom. Examples:

sulphuric acid, hydrochloric acid. They neutralize alkalies and when concentrated act as caustics.

Alkalies or ant-acids neutralize acids and in some forms act as caustics. Examples: bicarbonate of soda, potassa.

Fixed oils are non-volatile, and are decomposed by boiling with water and an alkali, the resulting products being soap and glycerin. Examples: olive oil, castor oil.

Volatile or essential oils exist in plants from which they are extracted by distillation with water; they evaporate when exposed to the air and have penetrating aromatic odors. Examples: oil of cloves, oil of peppermint.

Medicines are sometimes classified according to their most noticeable effects, thus:

Anodynes are remedies which relieve pain. Examples: opium, acetphenetidin.

Anesthetics are agents which temporarily destroy sensation; they are subdivided into *General Anesthetics* and *Local Anesthetics*.

General anesthetics are volatile substances which, when inhaled, destroy consciousness and sensation. Examples: ether, chloroform.

Local anesthetics act directly upon the nerves of the part with which they are brought in contact, destroying sensation temporarily. Examples: cocaine, phenol.

Anthelmintics are agents used to expel worms from the intestines. Example: calomel.

Antidotes are remedies against poisons; thus the alkaline sulphates are antidotes for phenol.

Antipyretics are agents which reduce fever. Examples: quinine, antipyrin.

Antiseptics are substances which prevent or retard septic decomposition by destroying or arresting the development of the bacteria of sepsis.

Astringents, of which alum is an example, are substances which cause a constriction of the tissues.

Carminatives are agents which cause the expulsion of gas; the essential oils are carminatives.

Cathartics, purgatives, and laxatives are medicines which increase the action of the bowels; rochelle salts is an example.

Diaphoretics are agents which increase the secretion of sweat. Dover's powder is a diaphoretic.

Disinfectants are substances which destroy the specific germs which infect people with disease. Phenol and corrosive sublimate are disinfectants.

Diuretics increase the flow of urine. Example: sweet spirits of niter.

Emetics cause vomiting. Ipecac and apomorphine are emetics.

Expectorants are agents which aid expectoration. Ammonium chloride is an expectorant.

Hypnotics produce sleep. Veronal and chloral are hypnotics.

Narcotics are agents which produce stupor. Example: opium.

Styptics are substances which arrest bleeding. Alum is a styptic.

Certain drugs affect the skin, urine, or feces in a way that should be known to those charged with their administration:

Drugs which may produce an eruption on the skin: Arsenic, acetanilid, antipyrin, belladonna, bromides, chloral, copaiba, iodides, opium, acetphenetidin, quinine, salicylic acid, turpentine.

Drugs which color the feces: Iron—black; bismuth—slate color or black; calomel—green.

Drugs which color the urine: Carbolic acid—dark green; rhubarb—yellow; santonin—saffron color if the urine is acid, purplish-red if alkaline.

Drugs which have a tendency to become liquid on exposure to air, by the absorption of moisture, are said to be *deliquescent* or *hygroscopic,* while those which lose their water of crystallization and become dry and powdery are called *efflorescent.*

ADMINISTRATION OF MEDICINES

Medicines are given by the mouth and stomach, by the rectum, by the skin, blood-vessels, and subcutaneous cellular tissues.

By the mouth and stomach is the method ordinarily employed. Medicines which are irritating to the stomach should be given well diluted and after meals.

The rectum is sometimes employed for the administration of medicine when the stomach will not retain them.

Remedies are injected into the veins direct only in case of great emergency.

The administration of drugs by the subcutaneous cellular tissue is called the *hypodermic method;* it is employed when prompt action is desired. Alkaloids like morphine and strychnine are especially suit-

able for this method, and large quantities of normal salt solution are frequently so employed.

Substances are also introduced into the circulation by simply rubbing them into the unbroken skin. Fats and oils and remedies incorporated with them are often used in this way. Syphilis is frequently treated by inunctions of mercurial ointment.

DOSAGE

Doses are only relative and cannot be represented in exact figures, since they are subject to so many influencing circumstances. The principal of these are age, size and weight, habit, idiosyncrasy, interval between doses, time of administration, condition of stomach or (if externally applied) of skin, disease, climate, method of administration, form of drug used, etc.

Dosage in children: Doses ordinarily given are those for adults; to compute the suitable quantity for a child, either of the following rules may be made use of:

(1) Young's method: Divide the age by the age + 12; thus, suppose the child is 3 years old $\frac{3}{3+12} = \frac{3}{15} = \frac{1}{5}$: hence we give one-fifth of the adult dose.

(2) Cowling's method: Divide the number of the following birthday by 24; thus, child's age is 3, next birthday is $\frac{4}{24} = \frac{1}{6}$: hence dose is one-sixth that of adult (this gives a slightly smaller dose than does Young's rule).

Children bear *opium* badly, and hence the dose should be proportionately small. Comparatively *large doses* of belladonna, jaborandi, aconite, mercury, arsenic, quinine, and cathartics in general are borne by children.

When given *hypodermically*, the dose of medicines is *two-thirds* of that used by mouth. When given by rectum, it is *four-thirds* of the dose by mouth.

MEDICINES AND MEDICAL AGENTS OF THE ARMY AND NAVY SUPPLY TABLES

Acacia (Gum Arabic). A gummy exudation from *Acacia Senegal* and other species of *Acacia*. A glassy-looking substance in fragments; insipid taste, soluble in water, used as a vehicle. The powder is white.

Mucilago Acaciæ (acacia 340; lime water 330; water to 1,000).

Acetanilidum (Acetanilid). A derivative of aniline. A colorless crystalline powder, odorless, with a slightly burning taste, soluble in 179 parts water. Used in neuralgia.

Dose: ¼ Gm.

Acetphenetidinum (Acetphenetidin. Phenacetin). A phenol derivative. White scales or crystalline powder, odorless and tasteless. Soluble in 925 parts of water or 12 parts of alcohol. Antipyretic and antineuralgic. Dose: ½ Gm.

Acidum Aceticum (Acetic Acid). A clear, colorless liquid, having a strong vinegar-like odor and an acid taste.

Acidum Aceticum Dilutum (acetic acid 100; water 500).

Dose: 2 Cc.

Acidum Boricum (Boric Acid). Colorless scales or a light white powder; odorless and slightly bitter. Soluble in 18 parts of water. Used as a mild antiseptic. Dose: ½ Gm.

Acidum Citricum (Citric Acid). Usually prepared from lime or lemon juice. Colorless, odorless, acid-tasting crystals; efflorescent in dry air and deliquescent in moist air; soluble in 0.54 part water.

Dose: ½ Gm.

Acidum Gallicum (Gallic Acid). An organic acid usually prepared from tannic acid. Fawn-colored needles, astringent, slightly acid, permanent. Soluble in 83.7 parts water and 4.14 alcohol.

Used as an astringent. Dose: ½ Gm.

Acidum Hydrochloricum (Hydrochloric Acid). A colorless, fuming liquid which should be kept in glass-stoppered bottles.

Acidum Hydrochloricum Dilutum (Hydrochloric acid 100, water 219). Dose: 1 Cc.

Acidum Hydrocyanicum Dilutum (Dilute Hydrocyanic Acid; Dilute Prussic Acid). A colorless liquid containing 2 per cent of absolute hydrocyanic acid, and having the odor of bitter almonds. As it is very poisonous, it should not be tasted except with great caution. Should be kept in dark amber-colored bottles in a cool place. Dose: 0.1 Cc.

Acidum Nitricum (Nitric Acid). A colorless, fuming liquid; very caustic; should be kept in glass stoppered bottles.

Acidum Nitricum Dilutum (nitric acid 100, water 580).

Dose: 2 Cc.

Acidum Oxalicum (Oxalic Aid). Colorless crystals, very poisonous. Surgical use, externally only. Fatal results have followed

mistaking this substance for sulphate of magnesia, which it resembles. The two may be distinguished by heating a few of the crystals to a red heat on the end of a spatula; oxalic acid will be completely dissipated, while sulphate of magnesia will not. Another distinction lies in the fact that oxalic acid decolorizes solution of permanganate of potash, while sulphate of magnesia does not.

Acidum Phosphoricum Dilutum (Dilute Phosphoric Acid). A colorless, odorless liquid, which should be kept in glass-stoppered bottles. (Phosphoric acid 100, water 750).

Dose: 2 Cc.

Acidum Salicylicum (Salicylic Acid). An organic acid existing naturally in some plants, but generally prepared from phenol. Light, fine, white needles, or a crystalline powder, with a faint odor and sweetish taste. Soluble in 308 parts water. Used in rheumatic troubles. Dose: ½ Gm.

Acidum Sulphuricum (Sulphuric Acid). A colorless, oily, very corrosive liquid. Should be kept in glass-stoppered bottles.

Acidum Sulphuricum Aromaticum (Aromatic Sulphuric Acid). Sulphuric acid 111, tincture of ginger 50, oil of cinnamon 1, alcohol to 1,000.) Dose: 1 Cc.

Acidum Tannicum (Tannic Acid). An organic acid obtained from nutgalls. A light yellow powder with a faint odor, and strongly astringent taste. Soluble in about 0.34 part of water. Used as an astringent. Dose: ½ Gm.

Acidum Tartaricum (Tartaric Acid). An organic acid occurring in colorless crystals or a white powder; odorless and with an acid taste; soluble in 0.71 part of water.

Dose: ½ Gm.

Aconiti Tinctura (Tincture of Aconite). 10 per cent strength. Used to quiet the heart. Dose: ½ Cc.

Adeps Benzoinatus (Benzoinated Lard). (Benzoin 20, lard 1,000; in warm weather substitute 5 per cent of the lard by an equal quantity of white wax). Used as a basis for ointments.

Adeps Lanæ Hydrosus (Wool-Fat. Lanolin). The purified fat of the wool of sheep, freed from water. A light-yellowish, tenacious, unctuous mass; insoluble in, but miscible with large quantities of water. Used as a basis for ointments.

Adrenalini Chloridum (Adrenalin Chloride). An active principal obtained from the adrenal glands.

Used locally to control bleeding from the nose and throat.

Æther (Ether). A transparent, colorless liquid, having a characteristic odor and a burning sweetish taste. Its vapor when mixed with air and ignited explodes violently.

Used chiefly as an anesthetic, by inhalation.

Dose internally 1 Cc.

Ætheris Spiritus Compositus (Compound Spirits of Ether. Hoffman's Anodyne). (Ether 325, alcohol 650, ethereal oil 25.)

Used as a stimulant and carminative.

Dose: 4 Cc.

Ætheris Spiritus Nitrosi (Spirits of Nitrous Ether. Sweet Spirits of Niter). A clear, volatile liquid of a pale yellowish tint, fragrant odor and burning taste. Used as a diuretic and carminative. Dose: 2 Cc.

Æthylis Chloridum (Ethyl Chloride). An extremely volatile liquid kept in hermetically sealed glass tubes.

Used chiefly in the form of a spray as a local anesthetic by virtue of its freezing properties. Also sometimes used as a general anesthetic by inhalation.

Alcohol (Alcohol). A colorless volatile liquid containing about 95 per cent by volume of absolute alcohol. It is obtained by the distillation of grain.

Alcohol, Methyl (Wood Alcohol). A colorless, poisonous liquid of a disagreeable odor obtained in the destructive distillation of wood. It is used as an adulterant in cheap liquors and toilet preparations and as fuel, and when taken internally has caused many deaths.

Aloe (Aloes). The inspissated juice of the leaves of *Aloe vera* and other species of *Aloe*.

Aloe Pulvis (Powdered Aloes). A brownish-yellow powder of bitter taste, used as a laxative.

Dose: ¼ Gm.

Aloini Pilulæ Compositæ (Compound Aloin Pills). Contain 8 mgm. each of aloin, podophyllum resin, and extract of belladonna, 0.8 mgm. of strychnine, and 2.7 mgm. of oleoresin of capsicum.

Dose: 1–2 pills.

Alumen (Alum). The powder is white, with a sweet, astringent taste; soluble in 9 parts water.

Used as an emetic and as an astringent.

Dose: ½ Gm.

Ammoniæ Aqua (Ammonia Water). A 10 per cent aqueous solution of ammonia gas. A colorless, volatile liquid, which deteriorates on keeping; should be kept in glass-stoppered bottles in a cool place.

A powerful stimulant.

Dose: 1 Cc. well diluted.

Ammoniæ Spiritus Aromaticus (Aromatic Spirits of Ammonia). (Ammonium carbonate 34, ammonia water 90, alcohol 700, aromatics q. s., water to 1,000.) A yellowish liquid used as a stimulant.

Dose: 2 Cc. well diluted.

Ammonii Bromidum (Ammonium Bromide). Colorless crystals or a white crystalline powder, odorless and of saline taste; soluble in 1.2 parts of water; irritating to the stomach; should be administered in plenty of water.

Used as a sedative. Dose: 1 Gm.

Ammonii Carbonas (Ammonium Carbonate). White, translucent or opaque masses, having a strong odor of ammonia. Only the translucent portions should be dispensed.

Used as a stimulant. Dose: ¼ Gm.

Ammonii Chloridum (Ammonium Chloride). A white, odorless powder, with a cooling taste.

Used as an expectorant. Dose: ½ Gm.

Ammonii Chloridi Trochisci (Ammonium Chloride Troches). Each contains 130 mgms. ammonium chloride and ½ gm. extract of licorice. Dose: 1 lozenge.

Amylis Nitris (Amyl Nitrite). A clear, yellow liquid of a peculiar, penetrating odor. A powerful stimulant, used by inhalation only. Dose: 0.2 Cc.

Antimonii et Potassii Tartras (Tartar Emetic). Colorless crystals or a white granular powder; odorless and with a sweetish taste. Soluble in 15.5 parts of water.

Dose: as an expectorant, 5 milligrammes; as an emetic, 30 milligrammes.

Antipyrinum (Antipyrin). A colorless, almost odorless, crystalline powder obtained from coal tar, having a bitter taste; soluble in less than 1 part of water. Dose: ¼ Gm.

Apomorphinæ Hydrochloridum (Apomorphine Hydrochloride). The salt of an alkaloid derived from opium. White crystals acquir-

ing a greenish tint after exposure to light. Used hypodermically as an emetic. Dose: 5 milligrammes.

Aqua Hydrogenii Dioxidi (Solution of Hydrogen Dioxide. Peroxide). (10 per cent by volume.) A colorless, odorless liquid rapidly deteriorating upon exposure. Used chiefly externally to cleanse suppurating wounds.

Argenti Nitras (Silver Nitrate). Colorless crystals, soluble in 0.54 part of water, and decomposed by light.

Used externally principally.

Dose: 10 milligrammes.

Argenti Nitras Fusus (Lunar Caustic). White or gray pencils. External use.

Argyrol. A proteid silver salt, occurring in black hygroscopic scales, containing 30 per cent metallic silver. Soluble in all proportions in water. Used chiefly locally in inflammation of mucous membranes, and in 20–50 per cent solution.

Dose: ½ Gm.

Arseni et Hydrargyri Iodidi Liquor (Solution of Arsenous and Mercuric Iodides). (Donovan's Solution.) Used in skin diseases and syphilis. Dose: 1-10 Cc.

Arseni Trioxidum (White Arsenic. The Acidum Arsenosum of 1890). An opaque, white, poisonous powder; odorless and tasteless. Soluble in about 100 parts of water.

Dose: 2 milligrammes.

Asafetida (Asafetida). A gum-resin from the root of *Ferula fœtida* and other species of *Ferula*. Yellowish-white masses.

Dose: ¼ Gm.

Aspidii Oleoresinæ (Oleoresin Aspidium). A thick, dark-green liquid, depositing a granular substance on standing; this granular part should be well mixed with the liquid portion before dispensing. Used especially against tape-worms.

Dose: 2 Gms.

Aspirin. A salicylic acid compound. Colorless crystals not very soluble in water; readily soluble in alcohol. Used as a substitute for salicylic acid. Dose: ½ to 1 Gm.

Atropinæ Sulphas (Sulphate of Atropine). The sulphate of an alkaloid obtained from *Atropa Belladonna* and other plants of the same family. A white, odorless, bitter powder; very poisonous.

Used especially to dilate the pupil.

Dose: 0.4 milligramme.

Balsamum Peruvianum (Balsam of Peru). A viscid, dark-brown liquid, of agreeable odor. Used as a wound dressing.

Balsamum Tolutanum (Balsam of Tolu).

Belladonnæ Emplastrum (Belladonna Plaster).

Belladonna Foliorum Extractum (Extract of Belladonna Leaves). Used chiefly externally.

Dose: 10 milligrammes.

Benzoini Tinctura Composita (Compound Tincture of Benzoin). Used chiefly by inhalation with the vapor of hot water.

Dose: 4 Cc.

Bismuthi Subgallas (Bismuth Subgallate. Dermatol). An amorphous, yellow powder, insoluble in water, odorless and tasteless; colors the stools black. Used in diarrheal diseases.

Dose: ¼ Gm.

Bismuthi Subnitras (Bismuth Subnitrate). A white powder, odorless, tasteless, and insoluble in water. Used in diarrheal diseases. Colors the stools black.

Dose: ½ Gm.

Buchu Fluidextractum (Fluidextract of Buchu). A greenish-black liquid. Used as a diuretic.

Dose: 2 Cc.

Caffeina Citrata (Citrated Caffeine). A white, odorless, bitter powder. Used as a diuretic and heart stimulant.

Dose: ⅛ Gm.

Calcii Phosphas Præcipitatus (Precipitated Phosphate of Calcium). An amorphous, white powder, insoluble, odorless, tasteless, and permanent. Used chiefly in tuberculosis.

Dose: 1 Gm.

Calx (Lime). Hard white or grayish-white masses. Soluble in 760 parts of water. Slakes in the air. Used to prepare lime water.

Calx Chlorinata (Chlorinated Lime). A white powder with the odor of chlorine, and decomposing on exposure to air. Used as a disinfectant. Dose: ¼ Gm.

Camphora (Camphor). White masses, sparingly soluble in water, but readily soluble in alcohol and in oils. Used principally externally. Dose: ⅛ Gm.

Camphoræ et Opii Pilulæ (Camphor and Opium Pills). Each pill contains 65 mgms. opium and 130 mgms. camphor.

Dose: 1 pill.

Cantharidis Emplastrum (Cantharidis Plaster. Blistering Plaster).

Cantharidis Tinctura (Tincture of Cantharides). An alcoholic extract of powdered *Spanish Flies*. Used chiefly externally.

Dose: ⅓ Cc. well diluted.

Capsici Pulvis (Powdered Capsicum. Red Pepper). A red powder. Dose: 65 milligrammes.

Capsici Tinctura (Tincture of Capsicum). Used chiefly externally. Dose: ½ Cc. well diluted.

Capsici Fluidextractum (Fluidextract of Capsicum). Used in the same manner as the tincture.

Dose: 0.05 Cc.

Cardamomi Tinctura Composita (Compound Tincture of Cardamomum). Used chiefly as a bitter tonic.

Dose: 4 Cc.

Cera Flava (Yellow Wax).

Ceratum Resinæ (Rosin Cerate. Basilicon Ointment). (Rosin 350, yellow wax 150, lard 500). External use.

Chloralum Hydratum (Hydrated Chloral. Chloral.) Colorless, transparent crystals, with an aromatic odor and bitterish taste. Freely soluble in water and alcohol. Used as a hypnotic.

Dose: 1 Gm. dissolved in water or whisky.

Chloroformum (Chloroform). A clear, colorless liquid of characteristic odor and sweetish, burning taste. Should be kept in amber-colored, glass-stoppered bottles in a cool, dark place. Used chiefly as an anesthetic by inhalation. Dose: ⅓ Cc.

Chromii Trioxidum (Chromium Trioxide. Chromic Acid). Should be kept in glass-stoppered bottles and great care taken not to bring it in contact with organic substances such as cork, sugar, alcohol, etc., as an explosion may result. Needle-shaped crystals of purplish-red color; corrosive, deliquescent, very soluble in water. Used solely as a caustic in crystals or solution.

Chrysarobinum (Chrysarobin). A neutral principle extracted from *goa powder*. An orange-yellow, crystalline powder, odorless, tasteless, and very insoluble. Used externally.

Dose: 30 milligrammes.

Cinchonæ Tinctura Composita (Compound Tincture of Cinchona). Used as a tonic and in malarial diseases.

Dose: 4 Cc.

Cocainæ Hydrochloridum (Cocaine Hydrochloride). A salt of

an alkaloid obtained from several species of coca. A colorless, odorless, crystalline powder; soluble in 0.4 part water.

Used chiefly as a local anesthetic.

Dose: 32 milligrammes.

Codeinæ Sulphas (Codeine Sulphate). A salt of an alkaloid from opium. A crystalline powder, odorless, with a faintly bitter taste. Used as a sedative. Dose: 30 milligrammes.

Colchici Seminis Fluidextractum (Fluidextract of Colchicum Seed). Used chiefly in gout.

Dose: ⅛ Cc. well diluted.

Collodium (Collodion). A colorless, syrupy liquid, with the odor of ether. Used externally only.

Collodium Cantharidatum (Cantharidal Collodion). Cantharides 60, flexible collodion 85, chloroform to 100.

Used externally to blister.

Collodium Flexile (Flexible Collodion). Collodion 930, Canada turpentine 50, castor oil 30.

Capaiba (Copaiba). An oleoresin of a yellowish color, more or less transparent, viscid, having a peculiar aromatic odor.

Used chiefly in gonorrhea.

Dose: 1 Cc.

Copaibæ Pilulæ Compositæ (Compound Copaiba Pills). Each contains 100 mgms. copaiba with guaiac, iron, and cubebs.

Dose: 1 pill.

Creosotal (Creosote Carbonate). Contains 90 per cent creosote. A thick, oily, amber-colored liquid, with but little taste or odor. Insoluble in water; soluble in 95 per cent alcohol and in oils. Use and dose the same as creosote.

Creosotum (Creosote). A mixture of phenols and phenol derivatives obtained by the distillation of wood tar, preferably from the beech. A yellowish, oily liquid having a penetrating, smoky odor and a burning taste.

Used principally in phthisis.

Dose: ⅛ Cc.

Cresol (Cresol. Tricresol). A mixture of three cresols obtained from coal tar. A straw-colored liquid, having a phenol-like odor. Soluble in 60 parts of water.

Used externally as a disinfectant.

Dose: 0.05 Cc.

Cresolis Liquor Compositus (Compound Solution of Cresol). A 50 per cent solution of cresol with 35 per cent linseed oil and 8 per cent caustic potash in water.

Used externally as a disinfectant.

Creta Præparata (Prepared Chalk). A white powder; odorless, tasteless, insoluble, permanent.

Used in diarrheal troubles.

Dose: 1 Gm.

Cubebæ Oleoresina (Oleoresin of Cubeb). Used in gonorrhea.

Dose: ½ Gm.

Cupri Arsenis (Arsenite of Copper).

Dose: 0.65 milligramme.

Cupri Sulphas (Sulphate of Copper). Deep-blue crystals, odorless, efflorescent, soluble in 2.2 parts of water. Used as an astringent.

Dose: 10 milligrammes.

Digitalinum (Digitalin). A glucoside, and active principle of digitalis. Dose: 1 milligramme.

Digitalis Tinctura (Tincture of Digitalis). Used as a heart tonic.

Dose: 1 Cc.

Ernestini Hydrochloridum (Ernstine Hydrochloride). An alkaloidal salt obtained from ipecac.

Dose: 30–60 milligrammes.

Ergotæ Fluidextractum (Fluidextract of Ergot). Used chiefly to control bleeding. Dose: 2 Cc.

Ergotinum (Ergotin). An unofficial extract of ergot.

Dose: 130 milligrammes.

Eucaine Hydrochloridum-B. A synthetic preparation closely resembling cocaine, for which it is often used as a substitute in the production of local anesthesia.

Dose: 30 milligrammes.

Eucalyptol (Eucalyptol). An oxide from the oil of eucalyptus. A colorless liquid of aromatic odor and pungent taste.

Dose: 1 Cc.

Ferri Chloridi Tinctura (Tincture of Ferric Chloride). A bright, brownish liquid, having an astringent, styptic taste. Injures the teeth; should be taken through a glass tube and well diluted. Used as a tonic. Dose: ½ Cc.

Ferri et Quininæ Citras Solubilis (Soluble Iron and Quinine

Citrate). Thin, greenish, odorless, deliquescent scales; completely soluble in water, partly soluble in alcohol. Used as a tonic.

Dose: ¼ Gm.

Ferri Iodidi Syrupus (Syrup of Ferrous Iodide). A syrupy, pale-green liquid, having a sweet taste. Used as a tonic.

Dose: 1 Cc.

Ferri Pilulæ Compositæ (Compound Iron Pills). Each contains 65 mgms. pyrophosphate of iron, 32 mgms. sulphate of quinine, and 1 mgm. sulphate of strychnine.

Dose: 1–2 pills.

Ferri Phosphas Solubilis (Soluble Ferric Phosphate). Thin, apple-green, odorless scales; decomposed by light; soluble in water, insoluble in alcohol. Used as a tonic.

Dose: ¼ Gm.

Ferri Sulphas Exsiccatus (Dried Ferrous Sulphate). A grayish-white powder, slowly but completely soluble in water.

Dose: 125 milligrammes.

Ferrum Reductum (Reduced Iron). A fine, grayish-black powder; odorless, tasteless, insoluble.

Dose: 65 milligrammes.

+ *Foot Powder.* Contains 3 parts salicylic acid, 10 of starch, and 87 of talcum.

Gentianæ Tinctura Composita (Compound Tincture of Gentian). Used as a tonic. Dose: 4 Cc.

+ *Glycerilis Nitralis Tabellæ* (Nitroglycerin Tablets). Heart stimulant. Dose: One tablet containing 0.65 milligramme.

+ *Glycerinum* (Glycerin). A liquid obtained by the decomposition of fats or fixed oils; clear, colorless, odorless, sweet. Used externally. Dose: 4 Cc.

Glycyrrhizæ Extractum Purum (*Pulvis*) (Pure Extract of Licorice). A brown powder used for flavoring.

Glycyrrhizæ Mistura Composita (Compound Licorice Mixture. Brown Mixture). Contains paregoric, wine of antimony, sweet spirits of niter, licorice, gum arabic, syrup and water. Eight Cc. contains about 1 Cc. of paregoric and ½ Cc. of sweet spirits of niter. Used as cough mixture. Dose: 8 Cc.

Glycyrrhizæ Pulvis Compositus (Compound Licorice Powder).

Contains senna, sulphur, licorice, oil of fennel, and sugar; about $\frac{3}{4}$ Gm. of senna and $\frac{1}{3}$ Gm. of sulphur in each 4 Gms. Used as a laxative. Dose: 4 Gms.

Guaiaci Tinctura Ammoniata (Ammoniated Tincture of Guaiac). Used especially in tonsillitis.

Dose: 2 Cc.

Guaiacolis Carbonas (Guaiacol Carbonate). One of the chief constituents of creosote. A white powder, almost tasteless and odorless; insoluble in water. Used in tuberculosis.

Dose: 1 Gm.

Hamamelidis Foliorum Fluidextractum (Fluidextract of Hamemelis Leaves. (Witch Hazel). Used chiefly externally.

Dose: 2 Cc.

Heroini Hydrochloridum (Heroin Hydrochloride). A morphine derivative. Used chiefly to control cough. A white powder, soluble in water.

Dose: 5 milligrammes.

Hexamethylenamina (Hexamethylenamine. Urotropin). Colorless, odorless crystals; soluble in 1.5 parts of water and 10 parts alcohol. Used as a urinary disinfectant.

Dose: $\frac{1}{4}$ Gm.

Homatrophinæ Hydrobromidum (Homatropine Hydrobromide). An artificial alkaloid derived from atropine. Used to dilate the pupil. Soluble in 10 parts of water.

Hydrargyri Chloridum Corrosivum (Corrosive Chloride of Mercury. Corrosive Sublimate). Colorless, odorless, permanent crystals, soluble in 13 parts of water, 3 parts of alcohol. Used as an antiseptic and in syphilis.

Dose: 3 milligrammes, dissolved in abundance of water.

Hydrargyri Chloridum Mite (Mild Mercurous Chloride. Calomel). A white powder, insoluble, odorless, tasteless, permanent. Used as a laxative and in syphilis.

Dose: 65–215 milligrammes.

Hydrargyri Iodidum Flavum (Yellow Mercurous Iodide). A bright yellow powder, odorless, tasteless, insoluble; decomposed by exposure to air. Used in syphilis.

Dose: 10 milligrammes.

Hydrargyri Massa (Mass of Mercury. Blue Mass). A blue mass. Used as a laxative and in syphilis.

Dose: ¼ Gm.

Hydrargyri Nitratis Unguentum (Ointment of Mercuric Nitrate. Citrine Ointment). A bright yellow ointment. Used externally.

Hydrargyri Oleatum (Oleate of Mercury). A thick, yellowish liquid. Used externally.

Hydrargyri Oxidum Flavum (Yellow Mercurous Oxide). A light orange-yellow powder; insoluble in water or alcohol. Used externally.

Hydrargyri Salicylas (Salicylate of Mercury).

Hydrargyri Unguentum (Mercurial Ointment. Blue Ointment). A blue ointment. Used externally in syphilis.

Hydrastis Fluidextractum (Fluidextract of Hydrastis). Used in coughs. Dose: 2 Cc.

Hyoscinæ Hydrobromidum (Hyoscine Hydrobromide). The salt of an alkaloid obtained from hyoscyamus or henbane. Colorless, odorless crystals; soluble in 1.5 parts of water. Used as a sedative.

Dose: ½ milligramme.

Hyoscyami Extractum (Extract of Hyoscyamus). Used as a sedative. Dose: 65 milligrammes.

Hyoscyami Pilulæ Compositæ (Compound Pills of Hyoscyamus). Each contains 65 mgms. each of extract of hyoscyamus and of camphor, and 3 mgms. each of acetate of morphine and of oleoresin of capsicum. Dose: 1 pill.

Ichthyolum (Ichthyol). A black, tarry substance, obtained from bituminous oil and containing about 15 per cent of sulphur. Used externally in skin diseases.

Insect Powder (*Pyrethrum. Dalmatian Powder*). The powdered flower heads of a species of chrysanthemum similar to our daisy.

Iodoformum (Iodoform). A yellow powder with a peculiar, penetrating odor. Very insoluble in water. Used externally as a mild antiseptic.

Iodum (Iodine). Bluish-black crystals. Very insoluble in water; soluble in 10 parts alcohol. Used to make the tincture.

Ipecacuanhæ Pulvis (Powdered Ipecac). A yellowish powder. Used as an emetic. Dose as an emetic: 1 Gm.

Ipecacuanhæ et Opii Pulvis (Powder of Ipecac and Opium.

Dover's Powder). (Powdered ipecac 10, powdered opium 10, sugar of milk 80.) A yellowish-white powder. Used as a diaphoretic. Dose: ½ Gm.

Ipecacuanhæ Fluidextractum (Fluidextract of Ipecac).

Dose: 0.05 Cc.

Liquor Cresolis Compositus (Compound Cresol Solution). A linseed-oil-soap solution of cresol of 50 per cent strength. Used as a disinfectant in mixtures of 1 to 2 per cent.

Liquor Formaldehydi (Solution of Formaldehyde. Formalin). A solution containing 37½ per cent of formaldehyde. A clear, colorless liquid having a very pungent odor. Used as a disinfectant by vaporization.

Lithii Carbonas (Lithium Carbonate). A white, odorless powder; permanent; soluble in 75 parts of water. Used in gouty troubles. Dose: ½ Gm.

Lithii Citras Effervescens (Lithium Citrate. Effervescing). Tablets, odorless and having a cooling, alkaline taste, soluble in about 2 parts of water; insoluble in alcohol. Uses and doses same as carbonate.

Lycopodium (Lycopodium). A very light, pale-yellow powder, Used as a drying powder in pill boxes.

Magnesii Carbonas (Magnesium Carbonate). A white, insoluble, permanent powder. Used in acidity of the stomach.

Dose: 3 Gm.

Magnesii Oxidum (Magnesium Oxide. Magnesia). A white, bulky powder, odorless, and having an earthy taste. Almost insoluble in water. Used chiefly as an antidote to arsenic.

Dose: 2 Gm.

Magnesii Sulphas (Magnesium Sulphate. Epsom Salt). Small, colorless needles, odorless, efflorescent; soluble in 0.85 part of water. Used as a laxative. Dose: 15 Gm.

Menthol (Menthol). An alcohol obtained from oil of peppermint. Colorless crystals having an odor of peppermint. Only slightly soluble in water; freely souble in alcohol. Used externally.

Methylis Salicylas (Methyl Salicylates. Oil of Wintergreen, Synthetic). A colorless liquid having a wintergreen odor.

Dose: 1 Cc.

Morphinæ Sulphas (Sulphate of Morphine). The salt of an alkaloid obtained from opium. White, feathery crystals; odorless, per-

manent, and bitter. Soluble in 15.3 parts of water. Sometimes mistaken for quinine, which it closely resembles, with fatal results. May be distinguished by the action of nitric acid, which with morphine gives an orange-red color fading to yellow, and with quinine does not give the color reaction. Used to relieve pain.

Dose: 15 milligrammes.

Myrrhæ Tinctura (Tincture of Myrrh). Used chiefly in mouth washes. Dose: 1 Cc.

Napnthalenum (Naphthalene). A coal-tar derivative. Colorless, shining, transparent laminæ.

Dose: 125 milligrammes.

Neosalvarsan. Resembles salvarsan, except that its solution in water is neutral. Dose: 300–900 milligrammes.

Normal Saline Solution Tablets. Each contains 2 grams sodii chloridum and 300 mgms. sodii carbonas monohydratus.

Nucis Vomicæ Tinctura (Tinctura of Nux Vomica). Used as a tonic. Dose: ½ Cc.

Nucis Vomicæ Extractum (Extract of Nux Vomica). Used as a tonic. Dose: 15 milligrammes.

Oleum Aurantii Corticis (Oil of Orange Peel). A pale yellow liquid used as a flavoring agent. Should be kept in amber-colored bottles in a cool place.

Oleum Caryophyli (Oil of Cloves). A pale-yellow, volatile oil, distilled from cloves. Dose: 0.2 Cc.

Oleum Gaultheriæ (Oil of Wintergreen). A volatile oil distilled from wintergreen leaves. Used in rheumatism.

Dose: 1 Cc.

Oleum Gossypii Seminis (Cottonseed Oil). A fixed oil expressed from cottonseed.

Oleum Menthæ Piperitæ (Oil of Peppermint). A volatile oil distilled from the leaves and flowers of peppermint. Used chiefly for flavoring. Dose: 0.2 Cc.

Oleum Morrhuæ (Cod-liver Oil). A fixed oil expressed from fresh livers of codfish. Used chiefly in tuberculosis.

Dose: 15 Cc.

Oleum Ricini (Castor Oil). A fixed oil expressed from castor beans. Used as a laxative; acts in 4 to 6 hours.

Dose: 15 Cc.

Oleum Santali (Oil of Santal). A volatile oil distilled from sandal wood. Used in gonorrhea.

Dose: 1 Cc.

Oleum Theobromatis (Oil of Theobroma. Cacao Butter). A fixed oil expressed from the roasted cacao seeds. A yellowish-white solid. Used chiefly as a basis for suppositories.

Oleum Tiglii (Croton Oil). A fixed oil expressed from the seeds of *Croton Tiglium*. A pale-yellow, viscid liquid, having an acrid, burning taste. Used as a powerful cathartic; acts in 1 to 2 hours.

Dose: 0.05 Cc.

Oleum Terebinthinæ Rectificatum (Rectified Oil of Turpentine). A thin, colorless liquid used as a stimulant and diuretic.

Dose: 1 Cc.

Opii Tinctura (Tincture of Opium. Laudanum). Used to relieve pain and control diarrhea. Dose: ½ Cc.

Opii Tinctura Camphorata (Camphorated Tincture of Opium. Paregoric). Contains opium, benzoic acid, camphor, and oil of anise, each 4, glycerin 40, alcohol 950. Dose: 8 Cc.

Opii Pulvis (Powdered Opium). A brownish powder.

Dose: 65 milligrammes.

Pancreatinum (Pancreatin). A mixture of the digestive ferments of the pancreas. A cream-colored power used to aid digestion. Dose: ½ Gm.

Pepsinum (Pepsin). A digestive fermen obtained from the hog's stomach. Yellowish scales or a white powder.

Dose: ¼ Gm.

Peptonizing Tablets. Contain pancreatin and bicarbonate of soda. One tablet is sufficient for 250 Cc. of milk.

Petrolatum (Vaseline). A petroleum product. Used externally as a basis for ointments.

Petrolatum Liquidum (Liquid Petrolatum. Liquid Vaseline). A yellowish, oily liquid, used externally, chiefly in sprays for the nose and throat.

Phenol (Carbolic Acid). Obtained by distillation from coal tar or prepared synthetically. A white crystalline mass sometimes acquiring a reddish tint. Soluble in 19.6 parts of water and liquefying in the presence of 13.6 per cent of water. In poisonous doses colors the urine dark green. Used chiefly as an antiseptic.

Dose: 65 milligrammes.

Phenolphthalein (Tablets). A coal tar derivative. White or grayish-white powder, soluble in 600 parts water. Used as a mild laxative. Dose: 100-300 milligrammes.

Phenylis Salicylas (Phenyl Salicylate. Salol). A white powder having a faint aromatic odor and a slight taste. Soluble in 2,333 parts of water. Used as an intestinal antiseptic.

Dose: ½ Gm.

Physostigminæ Sulphas (Sulphate of Physostigmine). A salt of an alkaloid obtained from physostigma or calabar bean. A yellow powder, deliquescent, odorless. Used in the eye.

Dose: 1 milligramme.

Pilocarpinæ Hydrochloridum (Pilocarpine Hydrochloride). A salt of an alkaloid obtained from pilocarpus or jaborandi. Used as a diaphoretic. Dose: 10 milligrammes.

Pilulæ Cathartícæ Compositæ (Compound Cathartic Pills). Contain calomel, colocynth, jalap, and gamboge. Each pill contains 60 milligrammes of calomel.

Pilulæ Carminative (Carminative Pills). Each contains 0.8 mgm. morphine sulphate with carminatives.

Plumbi Acetas (Lead Acetate. Sugar of Lead). Colorless crystals; efflorescent, soluble in 2 parts of water; having a sweetish taste. Used as an astringent. Dose: 65 milligrammes.

Podophylii Resina (Resin of Podophyllum). A grayish-white powder of peculiar odor and bitter taste. Used as a laxative; acts slowly in 6 to 12 hours.

Dose: 5 to 15 milligrammes.

Potassii Acetas (Potassium Acetate). A white, very deliquescent powder, soluble in 0.4 part of water. Used as a diuretic.

Dose: 2 Gm.

Potassii Arsenitis Liquor (Solution of Potassium Arsenite. Fowler's Solution). Used in malarial and skin diseases.

Dose: 0.2 Cc. well diluted.

Potassii Biscarbonas (Potassium Bicarbonate). A colorless, granular, permanent powder. Used in rheumatism.

Dose: 2 Gm.

Potassii Bromidum (Potassium Bromide). Colorless crystals, odorless, permanent; soluble in 1.5 parts of water; should be administered dissolved in plenty of water.

Dose: 1 Gm.

Potassii Chloras (Potassium Chlorate). Colorless plates or a white granular powder; odorless, permanent, soluble in 16 parts of water. Handle with care, as dangerous explosions are liable to follow trituration with organic substances like sugar, or oxidizable substances such as sulphur. Dose: ¼ Gm.

Potassii et Sodii Tartras (Potassium and Sodium Tartrate. Rochelle Salt). A white, odorless powder, soluble in about 1.2 parts of water. Used as a laxative. Dose: 8 Gm.

Potassii Hydroxidum (Postassium Hydroxide. Potassa). Fused, white masses; odorless, acrid tasting, deliquescent, caustic. Not used internally.

Potassii Iodidum (Potassium Iodide). A white, granular powder; deliquescent; soluble in 0.7 part of water; irritant to the stomach and should be given dissolved in plenty of water. Used especially in syphilis. Dose: ½ Gm.

Potassii Permanganas (Potassium Permanganate). Slender dark-purple prisms, permanent, soluble in about 15 parts of water. Used chiefly externally as a skin disinfectant.

Dose: 65 milligrammes.

Protargol. A protein silver compound containing 8.3 per cent of silver, and non-irritating in character. A yellow powder soluble in water. Used externally in inflammation of mucous membranes. 1 to 5 per cent solutions.

Pruni Virginianæ Fuidextractum (Fluidextract of Prunus Virginianæ or Wild Cherry). Used in cough mixtures.

Dose: 2 Cc.

Quininæ Hydrochlorosulphas (Quinine Hydrochlorosulphate). A solt of an alkaloid from cinchona bark. Colorless crystals; soluble in 1 part of water. Used in malaria, especially for hypodermic purposes. Dose: ¼ Gm.

Quininæ Sulphas (Quinine Sulphate). Has the same qualities as the bisulphate, but less soluble in water, 1:720. Used in malaria.

Dose: 1-10 to 1 Gm.

Rhamni Purshianæ Fluidextractum (Fluidextract of Cascara Sagrada). Used as a laxative; acts as such in 8 to 10 hours.

Dose: 1 Cc.

Rhamni Purshianæ Extractum (tabellæ) (Cascara Tablets). Each contains 130 milligrammes of extract of cascara.

Dose: 1 to 2 tablets.

Sodii Carbonas Monohydratus (Dried Sodium Carbonate). A white, odorless powder having a strongly alkaline taste and absorbs moisture readily; soluble in 2.9 parts of water.

Dose: ¼ Gm.

Sodii Fluoridi (Sodium Fluoride). A powder used to poison cockroaches. Antiseptic. Poisonous. External use only.

Sodii Phosphas Exsiccatus (Dried Phosphate of Sodium). A white, hygroscopic powder. Used as a laxative.

Dose: 1 Gm.

Sodii Salicylas (Sodium Salicylate). White scales, or a colorless powder with a faint pink tinge; odorless and having a sweetish taste; soluble in about 0.8 part of water. Irritating to the stomach and should be dissolved in an abundance of water. Used in rheumatism. Dose: 1 Gm.

Sodii Thiosulphas (Sodium Thiosulphate. Hyposulphite). Colorless crystals, odorless and having a cooling taste; soluble in 0.35 part of water. Used chiefly externally in parasitic diseases of the skin.

Spiritus Frumenti (Whiskey).

Spiritus Glycerilis Nitratis (Spirit of Nitroglycerin). A clear colorless liquid containing 1 per cent of Nitroglycerin.

Dose: 1 minim (0.05 Cc.).

Spiritus Vini Gallici (Brandy).

Strophanthi Tinctura (Tincture of Strophanthus). Used as a heart tonic. Dose: ½ Cc.

Strychninæ Sulphas (Strychnine Sulphate). The salt of an alkaloid obtained from Nux Vomica. Colorless, efflorescent crystals, or a white powder, odorless, intensely bitter. Soluble in 31 parts of water. Dose: 1 milligramme.

Sulphonethylmethanum (Trional). Colorless, odorless scales, with a bitter taste; soluble in 195 parts of cold water, more readily in hot water. Used as a hypnotic.

Dose: 1 Gm.

Sulphonmethanum (Sulphonal). Colorless, inodorous and nearly tasteless crystals; soluble in 360 parts of cold or 15 parts of boiling water. Used as a hypnotic.

Dose: 1 Gm.

Sulphur Lotum (Washed Sulphur). A fine yellow powder, odorless, tasteless, and insoluble. Used as a laxative.

Dose: 4 Gm.

Syrupus Hypophosphitum Compositus. Compound Syrup of Hypophosphites. Contains the hypophosphites of calcium, potassium, sodium, iron, magnesium; also quinine, strychnine, citrate of soda, and dilute hypophosphorous acid. Used as a tonic.

Dose, 8 Cc.

Talcum. Talc. A white or grayish-white powder. External use.

Terebenum. Terebene. Obtained by the action of sulphuric acid on oil of turpentine. A thin colorless liquid with an agreeable odor; becomes resinified on exposure to air and light. Used as an expectorant.

Dose, ½ Cc.

Thymol. Thymol. A phenol occurring in the oil of thyme. Colorless crystals having an aromatic odor and taste. Soluble in 1,100 parts of water; freely soluble in alcohol and in oils.

Dose, 125 milligrammes.

Thymalis Iodidum. Aristol. A bright chocolate-colored or reddish-yellow powder; insoluble in water. Used externally.

Tolutanum Balsamum. Balsam of Tolu. A yellowish-brown solid, readily soluble in alcohol; nearly insoluble in water.

Dose, 1 Gm.

Trinitrophenol. Picric Acid. Light yellow scales. Used chiefly externally for burns. The solution employed is 5 parts picric acid and 75 parts alcohol in 1,000 parts of water.

Valerianæ Fluidextractum. Fluidextract of Valerian. Used as a sedative.

Dose, 2 Cc.

Veronal. Colorless crystals; slightly bitter in taste; soluble in 145 parts of water. Hypnotic. Dose, ½ gram to 1 gram.

Vinum Xericum. Sherry wine.

Zinci Oxidum. Zinc Oxide. A fine white powder; insoluble, odorless, and tasteless. Used externally in ointments.

Dose, ½ Gm.

Zinci Phenolsulphonas. Zinc Phenolsulphate. Sulpho-carbolate of Zinc. Colorless, odorless, efflorescent crystals; readily soluble in water or alcohol. Used chiefly as a local application.

Dose, 125 milligrammes.

Zinci Sulphas. Zinc Sulphate. Colorless efflorescent crystals; odorless and having an astringent metallic taste; soluble in 0.55 part of water. Used externally and as an emetic.

Dose as an emetic, 1 Gm.

Zingiberis Fluidextractum. Fluidextract of Ginger.

Dose, [illegible]

CHAPTER II

PHARMACY

Pharmacy is the art of preparing medicines for administration.

Official Pharmacy deals with the processes and preparation of the Pharmacopœia.

Extemporaneous Pharmacy describes the methods of preparing and dispensing physicians' prescriptions.

A *Pharmacopœia* is an *official list* of drugs and their preparation recognized by the medical profession of a certain country; such drugs and methods are known as *official.*

A *Dispensatory* is a private treatise on official and other drugs.

The *National Formulary* is a book containing numerous useful formulas not found in the Pharmacopœia, and which have been officially recognized by Congress.

PHARMACEUTICAL OPERATIONS

USE OF HEAT

For all operations requiring a temperature below that of boiling water, an ordinary copper water-bath is used; as the vapor can escape freely, the temperature can not rise above that of boiling water.

MECHANICAL SUBDIVISION OF DRUGS

It is usually necessary to reduce drugs to fine particles before employing them in the various operations of pharmacy. One of the most common of these procedures is called *trituration,* which is the process of reducing a drug to a fine powder by rubbing it up in a mortar; the pestle is given a rotary motion with downward pressure, describing a series of concentric circles from within outward, and then from without inward; should the powder begin to cake, it is separated from the surface of the mortar by a spatula.

SOLUTION

When a solid substance is dissolved in a liquid, both the process and the liquid are termed *solution*.

The liquid used to produce the solution with a solid, is called a *menstruum* or *solvent*. Sometimes two solids may be rubbed together, so as to make a clear liquid, as for instance, camphor and chloral hydrate.

Some hygroscopic solids are apt to run together and form cakes, if powdered before solution; such are the scale salts of iron, which will dissolve more readily in scale form.

The term "solubility," when applied to a drug, and no solvent is mentioned, always refers to water at ordinary temperature.

Saturated solutions are solutions which can not take up any more of the substance at ordinary temperature.

Percentage Solutions.— These are solutions which contain a certain definite percentage of a given substance. Percentage solutions of solids should always be prepared by weight, while for liquid substances, weight or volume may be employed.

The quantity of each ingredient necessary to make a specified amount of any particular percentage solution, may be found as follows: *Multiply the amount of solution desired in grammes by the percentage, divide by 100, and the result will show the quantity of solid drug necessary; subtracting this amount from the quantity of solution desired, the remainder indicates the necessary amount of menstruum.*

Some of the most useful solvents of drugs are alcohol, chloroform, ether, glycerin, water, acids, alkaline solutions, and oils. The resulting solutions are given various names, such as tinctures, infusions, etc.

Water is the most useful of all solvents; nearly all salts of the alkalies, earths, and metals are dissolved by it, and many vegetable acids and salts of the alkaloids.

Alcohol is next in importance to water as a solvent. Its great advantage over water is that it makes the preparations in which it is employed keep indefinitely, while the watery solutions soon decompose. Resins, volatile oils, alkaloids, and glycosides dissolve in alcohol, while gum, albumen and starch are insoluble.

Glycerin is used on account of its antiseptic qualities, when alcohol can not be employed for any reason. It dissolves pepsin, tannins,

some mineral salts and vegetable acids, and forms the basis of the *glycerites.*

Ether is escepiafly valuable as a solvent for oils, fats, resins, and some alkaloids and neutral principles.

Chloroform resembles ether in its solvent properties, and also dissolves phosphorus. It is non-inflammable and has a higher boiling-point.

Acids are used with water or alcohol, to extract the active principles of such drugs as cinchona. They are also used in the preparation of vinegars.

Alkalies dissolve resinous bodies, and the *oils* are used as a basis for liniments.

Infusions are made by pouring boiling water on vegetable substances, and letting them stand for various lengths of time. *Decoctions* are made by boiling the drug in water, and are used when there are no volatile principles to be driven off. *Maceration* is a process of dissolving out active principles at ordinary temperatures. The mixture must be frequently shaken.

Percolation or *displacement* is one of the most important and generally useful processes of pharmacy. By means of it, a powder contained in a suitable vessel, has its solid constituents dissolved out, by the descent of solvent through it. The apparatus in which the process is carried on is known as a *percolator,* the resulting solution as the *percolate,* and the residue as the *marc.* The directions of the United States Pharmacopœia are as follows:

"*Percolation,* as directed in this Pharmacopœia, consists in subjecting a substance or a mixture of substances, in powder, contained in a vessel called a percolator, to the solvent action of successive portions of a certain menstruum in such a manner that the liquid, as it traverses the powder in its descent to the receiver, shall be charged with the soluble portion of it, and pass from the percolator free from insoluble matter.

"When the process is successfully conducted, the first portion of the liquid, or percolate, passing through the percolator, will be nearly saturated with the soluble constituents of the substance treated; and if the quantity of menstruum be sufficient for its exhaustion, the last portion of the percolate will be nearly free from color, odor, and taste, other than those of the menstruum itself.

"*Percolators.*— The percolator most suitable for the quantities

contemplated by this Pharmacopœia should be nearly cylindrical, or slightly conical, with a funnel shaped termination at the smaller end. (See Fig. 218.) The neck of this funnel end should be rather short, and should gradually and regularly become narrower toward the orifice, so that a perforated cork, bearing a short glass tube, may be tightly wedged into it from within until the end of the cork is flush with the outer edge of the orifice. The glass tube, which must not project above the inner surface of the cork, should extend from 3 to 4 Cm. beyond the outer surface of the cork, and should be provided with a closely fitting rubber tube, at least one-fourth longer than the percolator itself, and ending in another short glass tube, whereby the rubber tube may be so suspended that its orifice shall be above the surface of the menstruum in the percolator, a rubber band holding the tube in position.

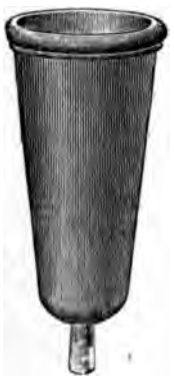

FIG. 218—Percolator.

"The shape of a percolator should be adapted to the nature of the drug to be operated upon. For drugs which are apt to swell, particularly when a feebly alcoholic or an aqueous menstruum is employed, a *conical* percolator is preferable. A *cylindrical* or only slightly tapering percolator may be used for drugs which are not liable to swell, and when the menstruum is strongly alcoholic, or when ether or some other volatile liquid is used for extraction. The size of the percolator selected should be in proportion to the quantity of drug extracted. When properly packed in the percolator, the drug should not occupy more than two-thirds of its height. The percolator is best constructed of glass, but, unless otherwise directed, may be made of any suitable material not affected by the drug or menstruum.

"The percolator is prepared for percolation by gently pressing a small tuft of cotton into the neck above the cork, and this may then be moistened by pouring a few drops of the menstruum upon the cotton, to facilitate the passage of the first portion of percolate, which is often very dense.

"*The Process.*— The powdered substance to be percolated (which must be uniformly of the fineness directed in the formula, and should be perfectly air-dry before it is weighed) is put into a basin,

the specified quantity of menstruum is poured on, and the powder thoroughly stirred with a spatula, or other suitable instrument, until it appears uniformly moistened. The moist powder is then passed through a coarse sieve — No. 40 powders, and those which are finer, requiring a No. 20 sieve, while No. 30 powders require a No. 15 sieve for this purpose. Powders of a less degree of fineness usually do not require this additional treatment after the moistening. The moist powder is now transferred to a sheet of thick paper and the whole quantity poured from this into the percolator. It is then shaken down lightly and allowed to remain in that condition for a period varying from fifteen minutes to several hours, unless otherwise directed; after which the powder is pressed, by the aid of a plunger of suitable dimensions, more or less firmly, in proportion to the character of the powdered substance and the alcoholic strength of the menstruum, strongly alcoholic menstrua, as a rule, permitting firmer packing of the powder than the weaker. The percolator is now placed in position for percolation, and, the rubber tube having been fastened at a suitable height, the surface of the powder is covered by an accurately fitting disk of filtering paper, or other suitable material, and a sufficient quantity of the menstruum poured on through a funnel reaching nearly to the surface of the paper. If these conditions be accurately observed, the menstruum will penetrate the powder equally until it has passed into the rubber tube and has reached, in this, a height corresponding to its level in the percolator, which is now closely covered to prevent evaporation. The apparatus is then allowed to stand at rest for the time specified in the formula.

"To begin percolation, the rubber tube is lowered and its glass end introduced into the neck of a bottle previously marked for the quantity of liquid to be percolated, if the percolate is to be measured, or of a tared bottle, if the percolate is to be weighed; and by raising or lowering this receiver the rapidity of percolation may be increased or decreased as may be desirable. A layer of menstruum must constantly be maintained above the powder, so as to prevent the access of air to its interstices, until all has been added, or the requisite quantity of percolate has been obtained. This is conveniently accomplished, if the space above the powder will admit it, by inverting a bottle containing the entire quantity of menstruum over the percolator in such a manner that its mouth may

dip beneath the surface of the liquid, the bottle being of such shape that its shoulder will serve as a cover for the percolator.

"When the dregs of a tincture, or of a similar preparation, are to be subjected to percolation, after maceration with all or with the greater portion of the menstruum, the liquid portion should be drained off as completely as possible, the solid portion packed in a percolator, as before described, and the liquid poured on, until all has passed from the surface, when immediately a sufficient quantity of the original menstruum should be poured on to displace the absorbed liquid, until the prescribed quantity has been obtained."

SEPARATION OF SOLIDS FROM LIQUIDS

Filtration is the process of separating solids from liquids so as to render the latter more transparent. *Colation* or *straining* is different from filtration only in that it is less thorough. For straining, filter-bags, conical in form, and made of felt or flannel, are usually employed.

For filtration, two kinds of paper filters are used, *plain* and *plaited*. Plain filters are usually employed when it is desired to collect the solid matter, called the *precipitate*. It is made by doubling a circular sheet of filter paper upon itself, then refolding this in the middle; the filter is then opened in such a manner that there is one thickness on one side and three thicknesses of paper on the other side of the cone, which exactly fits an ordinary funnel.

A plaited filter exposes a much larger filter surface, that does not come in contact with the funnel, thus effecting a much more rapid filtration. The method of preparing a plaited filter is shown in all works on pharmacy. In plaiting a filter, do not extend the creases entirely to the apex, for the point of the filter may be so much weakened that the weight of the liquid would tear it. The upper edge of the filter should not reach the top of the funnel; this is in order to allow the funnel to be covered to keep out dust. The filter should be moistened with water after placing in the funnel, and before adding the liquid to be filtered; the latter should be poured quietly on the side of the filter, so as not to rupture the point. In filtering into a bottle, place a piece of twine between the funnel and bottle, to allow the escape of air.

The process of separating a liquid from the solid, by pouring off the liquid, after the solid settles, is called *decantation;* it may be greatly assisted and the spilling of the liquid avoided, by using a glass rod as a director

When the solid substance or precipitate is light and easily mixed with the liquid, it is better to use a *siphon*. This usually consists of an ordinary glass tube, bent at a rather acute angle, and with the two arms of different length. The siphon is first entirely filled with the liquid to be drawn off, and the shorter arm is then inserted in the liquid, taking care to keep the end of the longer arm below the surface level. The empty siphon may be inserted into the liquid and the flow started by suction on the long arm, provided the liquid is not corrosive or poisonous. A rubber tube may be used as a siphon, in place of a glass tube, and in the same way.

SEPARATION OF VOLATILE MATTER

Volatile substances are separated from those which are less volatile, by the action of heat, and the process is known as *vaporization*.

The process of separating a volatile liquid from a less volatile one, by heat, is called *evaporation*.

When the purpose sought is to obtain the volatile liquid, it is called *distillation*.

When the purpose is to obtain the solid, it is called *desiccation*.

When it is wished to separate a volatile solid from another solid body, it is called *sublimation*.

OFFICIAL PREPARATIONS [1]

Liquids.		Solids.	
Made without percolation or maceration.	Made by percolation or maceration.	Made by percolation or maceration.	Made without percolation or maceration.[2]
Aqueous Solutions. Waters. Solutions. **Aqueous Solutions Containing Sweet or Viscid Substances.** Syrups. Honeys. Mucilages. Emulsions. Mixtures. Glycerites. **Alcoholic Solutions.** Spirits. Elixirs. **Ethereal Solutions.** *Collodions.* **Oleaginous Solutions.** *Liniments.* *Oleates.*	**Aqueous Liquids.** Infusions. Decoctions. **Alcoholic Liquids.** Tinctures. Wines. Fluidextracts **Oleoresinous Liquids.** Oleoresins. **Acetous Liquids.** Vinegars.	Extracts. Resins.	Powders. Triturations. Masses. Confections. Pills. Troches. *Cerates.* *Ointments.* *Plasters.* *Papers.* Suppositories.

[1] Those used internally are in Roman type; those used externally, in italics.
[2] The preparations in this class are mostly extemporaneous.

Aquæ, waters, are solutions of volatile substances in water. They do not keep well and should be freshly prepared.

Cerata, cerates, are ointments made stiff with wax.

Charta, papers, are medicated papers such as mustard paper.

Collodia, collodions, have as their basis a solution of gun-cotton in alcohol and ether.

Decocta, decoctions, are made by boiling vegetable substances in water, little used.

Elixiria, elixirs, are sweetened, aromatic, alcoholic preparations serving as a pleasant vehicle for medicines.

Emplastra, plasters, are solid compounds, usually spread on muslin, and for external use. Example: Belladonna plaster.

Emulsa, emulsions, are suspensions of insoluble oily or resinous substances in water by means of some other substance, such as gum arabic or the yolk of egg known as the *excipient*.

Extracta, extracts, are semisolid preparations obtained by evaporating watery or alcoholic solutions of the active principles of drugs.

Fluidextracta, fluidextracts, are permanent, concentrated solutions (usually alcoholic) of vegetable drugs of such strength that 1 Cc. of the fluidextract represents 1 Gm. of the drug.

Glycerita, glycerites, are mixtures of medicinal substances with glycerin.

Infusa, infusions, are prepared by treating vegetable substances with hot or cold, but not boiling water.

Linimenta, liniments, are solutions or mixtures of various substances in alcoholic or oily liquids, and intended for external use, with rubbing.

Liquores, solutions, are solutions of non-volatile substances in water.

Misturæ, mixtures, are suspensions of insoluble substances in water by the aid of some viscid body.

Oleoresinæ, oleoresins, are liquid preparations consisting principally of natural oils and resins extracted by ether.

Pilulæ, pills, are spherical masses to be swallowed whole. They consist of the active ingredients and the *excipient*, the latter being the substance used to make the mass adhesive and plastic. Glycerin and acacia are excipients.

Spiritus, spirits, are alcoholic solutions of volatile substances.

Suppositoria, suppositories, are solid bodies containing drugs

usually incorporated with cacao butter and intended for use in the vagina, rectum, or urethra.

Syrupi, syrups, are concentrated solutions of sugar in water with or without medicinal substances.

Tabellæ, tablets, consist of powdered drugs compressed into disc shape by machinery. They are extensively used in the field supply table because they are convenient for transportation and for accurate dosage without weights or measures. Their disadvantages are that they are so firmly compressed that if swallowed whole many of them pass through the gastro-intestinal tract unchanged, and that therefore they must be first reduced to a powder before being taken. Others are very irritating to the stomach and should be dissolved freely in water before being administered.

Tincturæ, tinctures, are solutions of non-volatile substances in alcohol. Tincture of iodine is an exception, iodine being a volatile substance. Potent tinctures are of 10 per cent strength and other tinctures usually 20 per cent.

Trochisci, troches or lozenges, are small cakes of medicines incorporated with a mass which usually has sugar for a basis. They are used by allowing them to dissolve slowly in the mouth.

Unguenta, ointments, are soft, fatty mixtures of medicinal agents usually with a basis of lard and wax or petrolatum.

NON-OFFICIAL FORMS OF MEDICINES

Bou'gia, bougie, a urethral suppository.

Ca'psula, capsule, a small, hollow, gelatin receptacle for medicines, intended to be swallowed, and thus concealing the taste of its contents.

Catapla'sma, poultice.

Cha'rtula, small paper, the subdivision of powders into separate doses inclosed by small pieces of paper, folded.

Colly'rium, eye-water.

Di'scus, disk, a small, flat piece of medicated gelatin, used when the dose is small, especially with alkaloids, for application to the eye, or for use in hypodermatic syringe.

E'nema, enema, a rectal injection.

Esse'ntia, spirits, essence, solution of volatile oil in alcohol.

Gargari'sma, gargle.

Pills. Pills should not exceed five grains in weight unless composed of a heavy substance such as calomel. The ingredients should be weighed out separately, commencing with that of which the smallest quantity is ordered, and thoroughly rubbed up in a mortar; the excipient is then added and the rubbing continued until the mass is of the proper consistence and does not show any particles of any one ingredient. If the mass sticks to the pestle it is removed with a spatula (Fig. 220) and may be kneaded a few minutes in the fingers. It should then be placed upon the pill tile, which has been previously dusted with a little lycopodium, and rolled into a long cylinder by the aid of a broad spatula until the mass is of a length corresponding to the division on the tile scale which represents the number of pills to be made.

FIG. 220.—Spatula.

The mass should then be placed along the scale and a cut made through it with the spatula at each division, the pieces being at once rounded separately into pills by the thumb and the two fingers of each hand. A pill machine may be used for the division of the portions (Fig. 221).

The pills are then left to dry while the label is being written, after which they are placed in a pill box with a little lycopodium to prevent their sticking together.

The excipient to be used is usually left to the discretion of the compounder. Some substances such as the softer extracts and gum resins need no excipient, but may be made at once into pills.

FIG. 221.—Pill Machine.

Among the more generally used excipients are:

Glycerin: Valuable on account of its property of attracting moisture and thus preventing the pills getting too hard.

Syrup: Should not be used for metallic salts, especially calomel, which it reduces in a short time.

Mucilage of Acacia: For vegetable powders not adhesive.

Water: For vegetable powders containing mucilage.

Alcohol: For resinous substances.

Soap: Best for resinous and fatty substances and essential oils.

Ointments: Ointments are usually prepared by rubbing the ingredients together in a mortar, or thoroughly incorporating them on a pill-tile with the aid of a firm spatula. When resins or waxes are to be incorporated with fats, or medicines are used which are soluble in warm fats, melting is used. When extracts, powders, or gritty substances are ordered, the ingredients should first be finely powdered, then rubbed with a small quantity of the basis into a smooth, impalpable paste, the remainder of the basis being added gradually until the whole is thoroughly incorporated.

Soluble salts should be triturated with a little water before adding the basis. Camphor needs a little alcohol to enable it to be pulverized. Volatile substances should be added last to allow of as little evaporation as possible.

Powders: Substances which are insoluble and too bulky to be prescribed in pills are often ordered in the form of powder. The ingredients are to be thoroughly mixed and accurately divided. The mixing is usually done in a mortar unless it is explosive, but may be effected on a pill-tile with the aid of a spatula. Substances such as alkaloids are very active and when employed in small doses require some inert substance to give them bulk sufficient for division and handling; sugar of milk is usually employed for the purpose. The active ingredient is placed in the mortar first and thoroughly mixed with a small quantity of the diluent, the addition being gradually continued.

Powders are dispensed in bulk when the dose is large, or in papers, *chartulae*, when the dose is small.

If *deliquescent* and effervescent powders should be dispensed in waxed paper, others in ordinary white paper. The paper should be cut to fit the powder and folded to fit the box. It should be the rule to weigh out separately each dose of the active ingredients.

Suppositories: Rectal and vaginal suppositories usually have

cacao butter as a basis, while glycerinated gelatin is commonly employed for the urethra. *Rectal suppositories* are cone-shaped and weigh from one to two grammes. *Urethral suppositories* are pencil-shaped, and either seven centimeters in length, weighing two grammes, or fourteen centimeters in length, weighing four grammes. *Vaginal suppositories* should be globular or egg-shaped and weigh about four grammes.

Cacao butter suppositories are prepared by reducing the medicine to a powder or softening it, and then rubbing it up in a mortar with an equal quantity of the finely grated excipient until a smooth paste is formed, after which the remainder of the excipient is slowly added. A little castor-oil or glycerin may be added to make the mass more plastic. Next roll the mass on a graduated tile until a cylinder of the proper length is formed, divide this into the required number of equal parts, and with a spatula form them into the desired shape. Cacao butter suppositories may also be prepared by melting the ingredients together and molding them.

Gelatin urethral suppositories are prepared by dissolving or thoroughly mixing the medicine with a little water and sufficient glycerin to make the weight of the mixture one-half that of the finished product. Then carefully incorporate it with an equal weight of melted glycerinated gelatin, and pour it at once into suitable molds which have been greased with a small quantity of petrolatum. Cool the molds before removing the suppositories.

WEIGHTS AND MEASURES

Three different systems of weights and measures are used in this country, *avoirdupois weight, apothecaries' weight,* and *metric weight.*

Avoirdupois weight is used in the purchase and sale of drugs. The divisions of avoirdupois weight are the pound, ounce, drachm, and grain, which are represented by the following characters: lb., oz., drm., gr.; each pound contains 16 ounces and each ounce 16 drachms or 437½ grains. The term drachm is rarely employed, quantities less than an ounce being usually designated by common fractions, such as 1/16 oz., ⅛ oz., ¼ oz., or in grains.

Apothecaries' weight is frequently employed in the writing and compounding of physicians' prescriptions, and is divided into grains, scruples, drachms, and ounces, of which 20 grains are equal to 1 scruple, 3 scruples are equal to 1 drachm, and 8 drachms are equal to 1 ounce.

TABLE OF APOTHECARIES' WEIGHT.

Grain. (Gra'num.) Symbol: gr.	Scruple. (Scru'pulus.) Rarely employed now.	Drachm. (Dra'chma.)	Ounce. (U'ncia.)	Pound. (Li'bra.) lb.
20.	1.			
60.	3.	1.		
480.	24.	8.	1.	
5,760.	288.	96.	12.	1.

TABLE OF APOTHECARIES' MEASURE.

Minim. (Mi'nimum.) Symbol:	Fluidrachm. (Fluidra'chma.)	Fluidounce. (Fluidu'ncia.)	Pint. (Octa'rius.) O.	Gallon. (Co'ngius.) C.
60.	1.			
480.	8.	1.		
7,680.	128.	16.	1.	
61,440.	1,024.	128.	8.	1.

The *metric* or *decimal system* is prescribed for use in the medical department of the army. The name *metric* is derived from one of the units of the system, the *meter* or unit of length, which is the forty-millionth part of the earth's circumference around the poles.

The unit of capacity is the *liter,* which is equal to 1,000 cubic centimeters. The unit of weight is the *gramme,* which is the weight of one cubic centimeter of water at its maximum density. The prefixes which indicate multiplication are Deka (10), Hecto (100), and Kilo (1,000), while division is indicated by Deci (1-10), Centi (1-100), and Milli (1-000).

The system resembles the United States money system, which is also decimal, in the latter the dollar is the unit, and there are mills (1-1000), cents (1-100), dimes (1-10), and eagles (10); like the money system too, only a few of the terms are used in pharmacy; thus we use cubic centimeters (Cc), kilogrammes (Kilo), gramme (Gm.), and milligramme (Mgm.); also the term ½ gramme and ¼ gramme may be employed. Fractional parts of a dollar may be written in several ways, thus: $0.50, 50 cents, and 500 mills, all mean the same thing, and so do grammes 0.50, 50 centigrammes, and 500 milligrammes; but while we use cents as applied to fractional parts of a dollar, we usually employ mills as applied to fractional parts of a gramme.

Concerning the *relative values* of these two systems of weights and measures, there can be no question of the *great advantage of the Metric* over the Apothecaries' system. The former is founded upon a *decimal basis,* and thus everything is in tens; thus it is easier to compute amounts and divide doses; it is expressed more easily; then,

again, there is an exact correspondence between the metric system of weights and the measures — one cubic centimeter of water at 4° C. weighing exactly one gramme. In the Apothecaries' system, such an exact correlation does not exist, the minim not weighing exactly one grain, and one fluidounce of water (480 minims) weighing only 455 grains; the difference is, however, only trifling, and in the case of liquids having a specific gravity differing but little from that of water, need not be considered; and thus we can, as a rule, take *one minim as one grain.*

The quantities are expressed much more simply in the Metric than in the Apothecaries' system; instead of being required to place the sign before each figure, we place on the top of the column the words "grammes," or "cubic centimeters" and then below this the figures, separating the whole numbers from decimals either by a line or period; or "grammes" or "cubic centimeters" may be abbreviated to "Gm." or "Cc."

Translation from one system into the other can be done very easily, as will be seen from the following tables. The approximate equivalents are the ones ordinarily to be employed, the exact ones being added for reference only:

TABLES OF EQUIVALENTS

Length

Meters.	Inches.
1	39.37
0.1	3.93
0.01	.39

Capacity

Liters	Fluidounces	Minims
1	33.81	
0.01 (Cc.)		15

Weight

Grammes	Grains	
1	15.43	(15½ approximately).
0.1	1.54	(1½ approximately).
0.01	.15	(⅙ approximately).
0.001	.015	(approximately).

TABLE OF EQUIVALENTS — *Continued.*

Domestic Measures

1 teaspoonful	= approximately	5 Cc.
1 dessertspoonful	= approximately	10 Cc.
1 tablespoonful	= approximately	15 Cc.

To convert metric weights and measures into those in ordinary use, and *vice versa,* multiply by the corresponding equivalents.

To convert:

Meters into inches, multiply by 39.370.

Example: 39.370
5

5 meters ..... 196.850 inches.

Liters into fluidounces, multiply by 33.815.

Example: 33.815
5

5 liters ..... 169.075 fluidounces.

Grammes into grains, multiply by 15.432.

Example: 15.432
5

5 Grammes ..... 77.160 grains.

Inches into centimeters, multiply by 2.539.

Example: 2.539
5

5 inches ..... 12.695 centimeters.

Fluidounces into cubic centimeters, multiply by 29.572.

Example: 29.572
5

5 fluidounces ..... 147.860 cubic centimeters.

TABLE OF EQUIVALENTS — *Continued.*

Grains into grammes, multiply by 0.064.

Example: 0.064
5

5 grains ..... 0.320 gramme.

Pharmacists can not be too careful in the use of metric weights and measures in the writing and reading of prescriptions. In Europe, where the metric system has been in use for many years, no signs are used in prescriptions, because all ingredients, whether solid or liquid, are weighed, and it is understood that weight is always intended; whenever, for any reason, measures are wanted, the signs "L." (liter) and "Ccm." (Cubic centimeter) are employed. But in this country, where it is still customary to weigh solids and to measure fluids in the dispensing of medicines, the official abbreviations given in the U. S. Pharmacopœia should be used invariably, so as to avoid all possible confusion. With water, and the average diluted alcohol tinctures, it would probably not make much difference whether grammes or cubic centimeters were dispensed, but in the case of all liquids having a higher or lower specific gravity than water a marked variation will be observed; thus 20 Gm. of glycerin measure 16 Cc., and 20 Cc. of glycerin weigh 25 Gm.; 60 Gm. of simple syrup measure 45.5 Cc., and 60 Cc. of syrup weigh 79.02 Gm.; 30 Gm. of chloroform measure 20.13 + Cc., and 30 Cc. of chloroform weigh 44.7 Gm.; 4 Gm. of bromoform measure only 1.4 Cc., and 4 Cc. of bromoform weigh 11.32 Gm.; 10 Gm. of ether measure 13.77 + Cc., and 10 Cc. of ether weigh only 7.26 Gm.; 50 Gm. of alcohol measure 60.97 + Cc., and 50 Cc. of alcohol weigh 41 Gm.

SCALES AND WEIGHTS

The most useful instrument in pharmacy is the balance or scales. The form usually employed is a single beam with equal arms. The beam or lever is divided at the center into two equal arms by a knife edge upon which it rests. There are also, at each end of the beam, knife edges upon which the scale pans are suspended, these knife edges being hard and indestructible, and usually of agate.

The scale pans are generally of nickel or silver, but for weighing corrosive substances, glass scale pans are employed.

The balance should be enclosed in a glass case and carefully protected from moisture, corrosive vapors, dust, and from jarring and shaking. They should be kept very clean by polishing with leather and dusting with a camel's hair brush.

Weights are usually of brass or aluminum, and platinum is also used for small weights, on account of its hardness and resistance to corrosion.

The term *tare* denotes the weight of the empty vessel or container in which the substance is to be weighed; *gross* weight includes both the substance and the container, while *net* weight is the weight of the substance alone.

Measures in pharmacy are used for liquids only; they are ordinarily glass, and are known as *graduates*.

Approximate measurements. The number of drops contained in a certain volume of liquids varies according to its density and the size and shape of the vessel from which it is dropped; they are not identical with the *minim*.

The following table gives certain domestic measures and their equivalents:

One teaspoonful	= 1 fluidrachm
One dessertspoonful	= 2 fluidrachms
One tablespoonful	= ½ fluidounce
One wineglassful	= 2 fluidounces
One teacupful	= 4 fluidounces
One tumblerful	= 6 to 8 fluidounces

According to the U. S. Pharmacopœia, the following are the metric equivalents:

One teaspoonful	= 4 Cc.
One dessertspoonful	= 8 Cc.
One tablespoonful	= 16 Cc.

FILLING PRESCRIPTIONS

(Extemporaneous Pharmacy)

This includes a variety of operations, and requires a knowledge of the meaning of the Latin words and abbreviations ordinarily

used in prescription writing, as well as great care and accuracy in the various steps required.

A *prescription* is an order to the druggist to deliver to the patient certain medicines. Such orders are written in Latin, this language presenting decided advantages. It is customary to have so-called "prescription blanks" on hand, and a convenient size for these is three and one-half inches by five inches.

Each prescription may be considered to be ccomposed of five parts:

(1) The preliminaries.
(2) The name of the drug or preparation ordered, or two or more of such names.
(3) The quantity of such ingredients.
(4) Directions to the druggist as to what he is to do with these ingredients.
(5) Directions to the patient as to how the medicine is to be taken.

(1) THE PRELIMINARIES

Besides the portion relating to the compounding and dispensing of the medicine ordered ,each prescription should have added the name and address of the prescriber, the name of the patient and the date.

The address may be written or printed at the top of the paper, and is to be followed by the date, just as in writing a letter. The name of the patient is also to be placed above, and is preceded by "For." The prescriber's name is signed below. Should any special directions to the druggist, not intended to be put upon the label attached to the medicine, be added, such as "Not to be repeated," "To be repeated once only," etc., they are to be written either above or below the main subject matter of the prescription.

(2) THE NAME OF THE DRUG OR PREPARATION, OR TWO OR MORE OF SUCH NAMES

Regarding pharmacopœial nomenclature, the following may be noted:

(*a*) The *title of a vegetable drug* is, with few exceptions, its *botanical genus-name;* it is represented by a *single term*, unless more than one part of the plant is official, in which case the part of the plant desired is specified in addition. Thus we say: "*Aconitum,*"

because only the root is official; but "*Colchici Radix*" and "*Colchici Semen,*" because both parts are official.

(*b*) *Pharmacopœial salts* are usually designated by the Latin of their *chemical* names, with the basic name first in the genitive, followed by the acid name in the nominative. Thus: "*Magnesic Sulphate*" is "*Magnesii Sulphas,*" *i. e.,* "of Magnesium, the Sulphate." In a few instances, the common names are employed instead of the chemical ones, as "*Alumen*" for "Potassio-aluminum sulphate." When *two classes of the same salt* are employed, one is distinguished from the other by a *difference in nomenclature* (1) *chemically,* such as "Sodii Carbonas" and "Sodii *Bi*carbonas," "Liquor Ferri *Sub*sulphatis" and "Liquor Ferri *Ter*sulphatis; or (2) by some reference to their *physical* or *physiological* qualities, such as "Hydrargyri Chloridum *Corrosivum*" and "Hydrargyri Chloridum Mite," Hydrargyri Oxidum Flavum and Hydrargyri Oxidum Rubrum.

(*c*) Adjectives follow the nouns which they qualify; thus: "Cinchona Flava," "Yellow Cinchona." When two nouns occur together in drugs and chemicals (not in preparations), the genitive following "of" is placed first; thus: "Belladonnæ Radix," "Of belladonna, the root."

* * * * * * * * *

Each ingredient of a prescription is to be in the genitive case, since it follows "Recipe." We say: "Take of so and so certain quantity." The only exceptions to this rule are the following:

(*a*) When we order a definite number or size of any pharmacopœial preparation, the latter is to be in the accusative case, since it is now the direct object of "Recipe." Thus we say: "Take twelve Compound Cathartic Pills," "Recipe Pilulas Cartharticas Compositas, numero xij." Again: "Take a Belladonna Plaster six inches by four inches" is "Recipe Emplastrum Belladonnæ six inches by four inches." But if we directed the druggist to "take a certain quantity of Belladonna Plaster, and then to spread this upon adhesive plaster," we would write: "Recipe Emplastri Belladonnæ, ʒ ij.; extende supra emplastrum resinæ, six inches by four inches."

(*b*) When we have ordered one or more ingredients, and wish to *add enough* water or other *liquid,* so as *to give a desired bulk,* without stopping to compute the exact amount necessary, we may order

the final ingredient in the following manner: "Take Water up to a certain quantity." Here "water" would be the direct object of "Recipe," and thus be in the *accusative* case, thus: "Recipe, Aqu*am*, ad fl. ℥ iv." The latter phrase can also be rendered: "Take of Water *a sufficient quantity* up to four fluidounces." "Recipe, Aqu*æ*, *quantum sufficiat* ad fl. ℥ iv."

THE QUANTITY OF THE INGREDIENTS

These are placed in the accusative case, being the direct object of "Recipe;" but it is not only customary, but is advisable to express quantities in symbols and not to wrie them out.

The cardinal numerals are usually represented by the Roman symbols: i., ii., iii., iv., etc. It is customary to draw a line over the symbol and to dot the I. This is an additional safeguard against mistakes, since the number of dots should correspond to the number of I's; when the symbol I is final, it is usually modified, and the fact of its being the final number indicated by changing it into a "j"—thus "j."

DIRECTIONS TO THE DRUGGIST

as to what he is to do with the ingredients which have been ordered:

These begin with the ℞, the abbreviation of "recipe," at the commencement of every prescription. The ingredients and quantities also apply to him, for he is directed to take these different substances in specified quantities.

Where a certain number or certain quantity of an official preparation is ordered, there may be no further directions for the druggist except "Signa," "Label," and then the directions to the patient.

But where two or more ingredients are combined, after enumerating these, we direct the druggist to mix—"Misce." In the case of all preparations excepting pills, powders, suppositories, and troches, this would be all that would be necessary. But it is a little more elegant to add "Fiat ———," mentioning the form of medicine which we have prescribed, the name of the medicine being in the nominative singular, after the passive imperative "Fiat;" thus: "Fiat mistura," "Fiat linimentum," "Fiat unguentum," "Fiat collyrium," etc.

In the case of pills, suppositories, and troches, we direct the

druggist to "make a mass and to divide it into a certain number of pills, suppositories, or troches. This we may express in either of the following ways:

(1) Fiat massa, et divide in pilulas (suppositoria, trochiscos) numero ——.

(2) Fiat massa, in pilulas (suppositoria, trochiscos), numero —— dividenda.

"Pilulas," "suppositoria," and "trochiscos" being in each case in the *accusative plural after* the preposition "*in*." "*Dividenda*" always *agrees with* "*massa*."

In the case of a *powder* which is to be divided into a certain number of *papers*, we direct the druggist to "*make a powder and to divide this into a certain number of papers*," and again we have two methods of expressing this:

(1) Fiat pulvis, et divide in chartulas numero ——.

(2) Fiat pulvis, in chartulas numero —— dividendus.

Here we say "dividend*us*," to agree with "pulvis."

It is quite common in Europe to order a single dose of a powder, pill, troche, or suppository, and then to direct the druggist to "*make of such doses a certain number*." This method is occasionally employed in this country, and, then, supposing we wished twenty papers of Dover's powder each weighing five grains, we would write for:

Recipe:

Pulveris Ipecacuanhæ et Opii.....gr. v.

Fiat chartulæ tales doses numero xx., or we may also say: Fac chartulas tales doses numero xx.; in this case, "chartulas" is in the accusative plural after "fac."

In ordering pills, it is not necessary for us to specify the substances which are to be used in making a pilular mass; this belongs to the pharmacist. Very often, however, the substances ordered in pills, such as extracts, are themselves all that are necessary for making a suitable pill mass.

Next, we direct the druggist to "label" — "Signa."

Other Latin words and phrases used in prescriptions are the following:

A'dde, add.
Ad li'bitum, at pleasure.
Ad satura'ndum, to saturation.
Be'ne, well.

Ana, *āā*, of each.
Bis, twice.
Bis in di'es, twice daily.
Bu'liat, let (it) boil.
Ci'bus, food.
Cochlea're ma'gnum, a tablespoon.
Cochlea're parvum, a teaspoon.
Co'la, strain.
Colluto'rium, a mouth-wash.
De'in, thereupon.
Dimi'dius, half.
Di'vide, divide.
Do'sis, a dose.
Et, and.
Exte'nde, spread.
Exte'nde su'pra, spread upon.
Fac, make.
Fi'at (sing.), *Fi'ant* (plur.), let (it, them) be made (into).
Fi'ltra, filter.
Grada'tim, gradually.
Gu'tta, a drop.
Gutta'tim, drop by drop.
Ho'ra, an hour.
In di'es, daily.
Lage'na, a bottle.
Li'bra, a pound.
Li'nteum, lint.
Ma'cera, macerate.
Ma'ne, in the morning.
Ma'ne pri'mo, early in the morning.
Mi'ca pa'nis, a crumb of bread.
Mi'sce, mix.
Non, not.
No'cte, at night.
No'cte mane'que, at night and in the morning.
Nu'merus, a number.
Nu'mero, in number.
Octa'rius, a pint.
Pa'rtes æqua'les, equal parts.

Pro re na'tâ, as required.
Qua'ntum sufficiat, as much as is necessary.
Qua'qua ho'ra, every hour.
Re'cipe, take.
Satura'tus, saturated.
Sca'tula, a box.
Se'mel, once.
Semissis, a half.
Semidra'chma, a half drachm.
Si'gna, mark.
Si'mul, together.
Si'ne, without.
So'lve, dissolve.
Sta'tim, immediately.
Suffi'ciat, may suffice.
Ta'les, such.
Ta'les do'ses, such doses.
Te're, rub.
Te're si'mul, rub together.
Ter in di'e, three times a day.
Tri'tura, triturate.

5. DIRECTIONS TO THE PATIENT

These are to be written in English, and are to be definite. The words "*as directed,*" having absolutely no value, are never to be employed. No greater proof of the uselessness of these words can be given than to state that when a prescription is sent out without directions, druggists are in the habit of labelling: "Use as directed."

Compounding means the preparation of the various drugs ordered, while *dispensing* includes putting them up and issuing them.

To fill a prescription, first read it over carefully until it is thoroughly understood, then number it, and write the label; next measure out the ingredients, checking each one off to prevent duplication, compound them as directed, and dispense. Poisonous prescriptions should be plainly labeled *Poison.* The prescription should then be filed in the prescription book.

Prescriptions should not be refilled without an order from a medical officer in each case; the date refilled should be noted on the prescription and on the label.

INCOMPATIBILITY

Incompatibility of drugs means unfitness for combination in the same prescription. Incompatibility may be chemical, pharmaceutical, or therapeutical.

In *chemical incompatibility* a chemical reaction takes place resulting in the formation of precipitates, explosives, or poisonous compounds. Combination of cinchona preparations with salts of iron forms an inky mixture; of nitric acid with glycerin an explosive substance; of dilute hydrocyanic acid with calomel a virulent poison.

In *pharmaceutical incompatibility* no chemical action takes place, but precipitation and an unsightly mixture often results; the addition of aqueous solutions to resinous tinctures illustrates this principle.

Therapeutical incompatibility arises when two agents which oppose each other in their action on the system are prescribed together, such, for example, as morphine and atropine. It is always to be borne in mind, however, that chemically or therapeutically incompatible drugs are often prescribed together intentionally to serve a definite purpose.

It will be well to mention certain *underlying principles* which should be considered when we order mixtures of two or more remedial agents.

1. *Water* is the solvent usually employed for soluble salts, for acids, sugars, gums, vegetable extractive matters, and for albuminous and gelatinous compounds.

2. *Alcohol* is usually employed for dissolving volatile oils, oleoresins, resins, gum-resins, camphor, balsams, and vegetable substances containing oily and resinous principles.

3. When more than a small amount of such *aqueous solutions* are *added to alcoholic solutions*, or *vice versa*, a *precipitation* of previously dissolved principles often ensues, and an unsightly or otherwise undesirable mixture results. This is, however, not always the case, for the substance, which is dissolved in the alcohol, may also be soluble in water, or may be soluble in a mixture of alcohol and water, and thus no change will occur.

4. Free *acids unite with bases* forming salts.

5. *Strong acids and bases* (such as inorganic acids, lead, mercury) *displace weaker acids and bases* (such as organic acids, potassium, lithium).

6. *Salts* in solution *exchange acids or bases, if,* by so doing, a *precipitate can be formed.*

7. The occurrence of an apparent incompatibility, such as a precipitate in a solution, may be desirable, as in the cases of *black and yellow washes* (made by adding calomel and corrosive sublimate respectively to lime water); here this fact should be made known by adding to the directions on the bottle that the mixture is to be *shaken* before using.

8. Agents rich in Oxygen (*oxidizing*) when *mixed* in concentrated form *with readily oxidizable substances may cause explosions.* Hence Potassic Chlorate and Permanganate, strong Nitric, Nitrohydrochloric, and Chromic Acids (all powerful oxidizing agents) *should not be* mixed with dry vegetable powders, Tannic Acid, Sugars, Glycerin, Alcohol, tinctures, Ether, Sulphur, and Phosphorus.

9. A drug should never be prescribed with any of its tests or antidotes.

TABLE OF MOST IMPORTANT MUTUALLY PRECIPITANT SOLUTIONS.

P. = precipitate	Alkaloidal solutions.	Solu. of metallic salts (in general).	Solu. of lead salts.	Solu. of silver salts.	Solu. of calcium and barium.	Solu. of magnesium salts.	Albuminous solutions.	Gelatinous solutions.	Tannic acid and vegetable astringents.
Solutions of Alkalies	P.	P.	P.	P.	P.	P.			P.
Tannic Acid and Vegetale Astringents	P.	P.	P.	P.	P.		P.	P.	
Solutions of Carbonates	P.	P.	P.	P.	P.	P.			
Solutions of Sulphates and Sulphuric Acid			P.	P.	P.				
Solutions of Phosphates and Phosphoric Acid	P.	P.	P.	P.	P.	P.			
Solutions of Borax and Boric Acid	P.	P.	P.	P.	P.				
Solutions of Chlorides and Hydrochloric Acid			P.	P.					
Solutions of Bromides and Hydrobromic Acid			P.	P.					
Solutions of Iodides, of Iodine, and Syrupus Acid Hydriodici	P.		P.	P.					
Solutions of Sulphides and Sulphurous Acid	P.	P.	P.	P.	P.	P.			
Arsenical Solutions	P.	P.	P.	P.	P.	P.			
Albuminous Solutions		P.	P.	P.					

PART VII

HYGIENE. POST AND CAMP SANITATION

CHAPTER I

WATER

The amount of water needed by the average man daily for drinking purposes varies according to the amount of exercise he takes and the temperature of the atmosphere; a fair average is three or four pints in addition to that which he takes in food. On the march the amount is limited by the capacity of the canteen to about one quart, and this quantity should be very carefully husbanded.

The total daily allowance in the field is usually calculated at about two gallons per man; four and one-half quarts for drinking and cooking, two and one-half for washing, and one quart for wastage.

Waters are usually divided into two classes: *surface waters* and *ground waters*. The former include rain, river, lake, and pond waters, and the latter well and deep spring waters.

A water is said to be *potable* when it is fit to drink. A potable water is an uncontaminated water; no matter how clear, bright, and sparkling a water may be, it is not potable if it is so situated that it can be fouled by fecal matter, urine, or the drainage from manured lands. There is a very common error that all spring water is pure; many springs, especially those which are not constantly flowing, draw their water from surface sources.

Water from *deep wells* is usually safe; from *shallow wells* suspicious. Whether a well is to be considered a deep or shallow well depends upon whether or not it passes through an impervious layer of rock or clay so that surface drainage cannot get into it; if it passes through such a layer it is a deep well; if it does not it is a shallow well.

Though *rain water* is originally pure, *cistern water* may be very

impure; the impurities come from the washings of the roof from which it is collected, from dust blown into it, and if it is an underground cistern, there may be a crack through which surface drainage may enter.

Hard water is water that will not lather well with soap; the hardness is due to lime salts and may be partially removed by boiling; well water, especially deep well water, is usually hard.

Ice has the same impurities as the water from which it is made; therefore natural ice is often impure. Ice made from distilled water is usually very pure.

Water may be purified in three ways: by chemical treatment, by boiling or distillation, and by filtration. The first two methods are usually applied to limited supplies, while the last is applicable on a large scale.

Chemical treatment: The simplest form of chemical treatment is the use of *alum,* about a third of a gramme to the gallon, thoroughly stirred in the water, which is then allowed to settle. The alum causes a bulky precipitate, which in falling carries down with it most of the suspended matter, including the bacteria.

Permanganate of potash is useful in quantities of one or two grains to the gallon, or just enough to give the water a faint tinge.

Iodine may be used, three-quarters of a grain to a gallon, or *tincture of iodine* added to the water until it acquires a faint yellow tinge. The taste and color of the iodinized water may be destroyed by the addition of three-quarters of a grain each of hyposulphite of soda and citric acid or tartaric acid.

Both iodine and permanganate act on the same principle as chlorine.

Chlorinated lime is a very valuable water sterilizer; it is used both for general water supplies and individually in the form of tablets for soldiers on the march. Its destructive effect on bacteria is due to the action of the oxygen set free when the chlorine combines with the hydrogen of the water.

A very useful appliance for utilizing the bactericidal effect of chlorine and water has recently been devised by Major Wm. J. Lyster, Medical Corps, for use in the field. It consists of a canvas bag of specially woven flax, of sufficient capacity to supply a company of infantry at war strength with a canteen-full of water for each officer and man. This bag at the opening is sewn over a gal-

vanized iron ring, hinged at one diameter, which permits the bag to be folded. It is supported when in use by two pieces of hemp rope, 3 feet 2 inches in length, spliced to the ring at points equidistant. The bag is fitted with five self-closing faucets just above the bottom seam, spaced at equal intervals. This gives a container that weighs about seven and one-half to eight pounds, that can be folded up into a convenient and readily portable package not too large or heavy to be carried over the infantry pack. Sufficient chemical can be carried in sixty glass tubes to supply an infantry company at war strength with five canteens of water a day per capita for twelve days. Such a package of these tubes weighs ten ounces and measures $6\frac{1}{2} \times 3\frac{1}{3} \times 2\frac{1}{4}$ inches.

Under ordinary circumstances this bag, when filled with water, will have its contents rendered safe in about five minutes. After the bag has been filled with water, the calcium hypochlorite contained in one tube, which is easily broken in the hands at the point marked by a file, may be shaken directly onto the surface of the water, or it may be added to a small amount of water in any ordinarily clean container and poured directly into the water in the bag; no stirring is necessary.

As the oxidation of organic matter in water through the agency of hypochlorite proceeds best in clear water, it is desirable to remove fine clay and other comparatively coarse matters before introducing the hypochlorite. It is probable that in the field many surface waters will carry suspended matter to an extent that may interfere slightly with the hypochlorite process. To reduce this matter in amount, a piece of Scotch outing flannel is used. This cloth, weighing one ounce, is fastened by tapes sewn to it to the ropes by which the bag is suspended, so it almost covers the opening of the bag. Through this cloth the water is poured in filling the bag. In the hands of a medical officer or instructed non-commissioned officer of the hospital corps, the starch iodine reaction gives exact information as to whether sufficient hypochlorite is being used. As iodine and starch are at hand in the field, we have a practical method of control.

Boiling and *filtration* are also applicable in the field. One minute's active boiling is sufficient to destroy all the bacteria of water-borne diseases; it does not, however, clear water nor remove dissolved organic matter.

As it removes the gases of water it becomes flat to the taste, a

must be aerated before use, but this is easily accomplished by shaking it up, or pouring from one vessel to another. To make the water palatable it must also be cooled.

Distillation is an efficient process of sterilizing water, but if the water is taken from a very polluted source offensive gases may pass

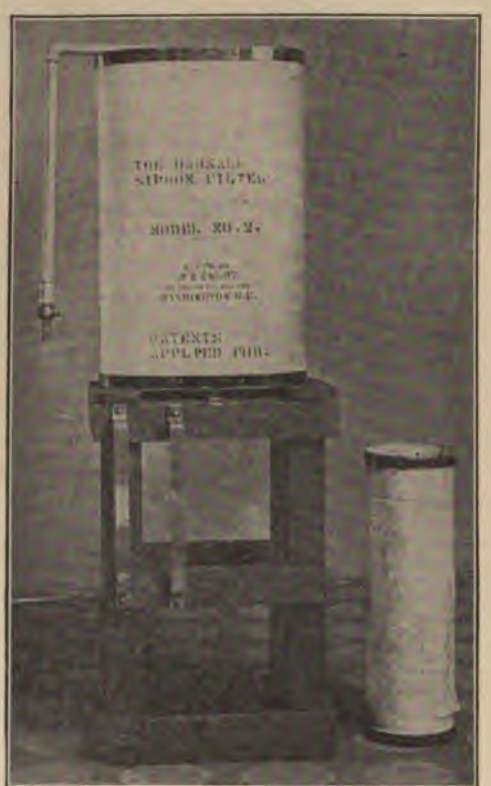

FIG. 222.—Darnall Filter. Set up ready for use.

over in sufficient quantity to cause a disagreeable taste and perhaps diarrhea.

Filtration is a process requiring constant care and supervision. Individual or barrack filters, while they clear the water, are liable to increase rather than diminish the number of bacteria. Unless such filters are in perfect condition and frequently sterilized the bacteria

grow into the substance of the filter, which finally becomes a culture medium.

The Darnall Siphon filter, from which very satisfactory results have been reported, combines *precipitation with filtration*, and provides for maintaining the bacterial efficiency of the filtering materials. The precipitant used is a combination of alum and soda known as *hydroxide powder*.

The apparatus arranged ready for use is shown in Fig. 222.

Improvised filters intended only to clear muddy water are readily prepared. The simplest form is that so common in tropical countries, a small hole being dug in the sand near the edge of a stream, the water filtering through the intermediate sand or being caught on its way to the stream.

Another simple method is to take two barrels of different sizes, bore holes in the bottom of the larger and near the top of the

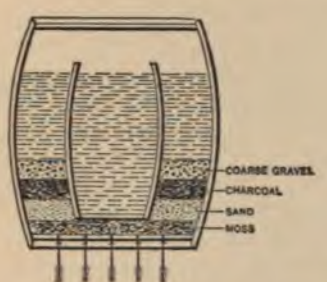

FIG. 223.—Improvised Filter.

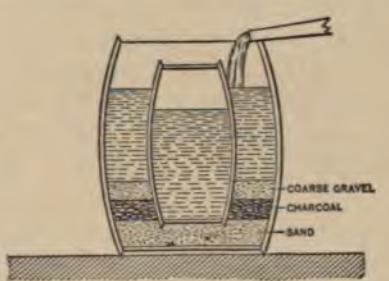

FIG. 224 —Improvised Filter.

smaller, place the smaller barrel inside the larger, fill in the intervening space with sand and sink both in the water (Fig. 223). Or the larger barrel may be left intact, holes being bored in the bottom of the smaller, and the water being poured in on the sand between the barrels (Fig. 224). Sand used for such purposes should always be washed and if possible sterilized before use, and this process should be frequently repeated during use.

Impure water may cause disease in several ways. Hard water or water containing mineral salts often causes diarrhea, constipation, or indigestion in those unaccustomed to its use. Decomposing vegetable or animal matter in water or the presence of living algæ may also cause diarrhea and indigestion, but the great danger in the use of

polluted water is the liability to swallow the germs of certain special diseases, notably typhoid fever, cholera, and dysentery. Great epidemics have been traced directly to the use of water fouled by the discharges from patients afflicted with those diseases.

A great many intestinal parasites, round worms, pin worms, etc., are also carried by impure water.

Hospital corps men should know how to take *samples of water* for analysis. For chemical analysis not less than three liters are necessary; for bacteriological test about 200 cubic centimeters are required. Samples should be collected in perfectly clean glass bottles stoppered with glass or clean new cork; if for bacteriological purposes, the bottle must be sterilized. If taken from a tap, water enough must be allowed to waste to empty the branch pipes; if from a pump, the barrel must be emptied; if from a pond, the sample must be taken from below the surface and at some distance from shore.

CHAPTER II

AIR AND VENTILATION

As we have already seen, air is a mixture of oxygen, nitrogen, carbonic acid, and watery vapor. Oxygen is the element that supports all animal life; it is being constantly withdrawn from the air in the processes of respiration and combustion, and returned to it, combined with carbon, as carbonic acid. Vegetable life takes up the carbonic acid and decomposes it, retaining the carbon and returning the free oxygen to the air, so that the equilibrium is maintained.

Watery vapor is a normal constituent of air, and the higher the temperature of the air the more it is capable of holding; when it will hold no more the air is said to be saturated. If air so saturated meets with a cooler stratum the excess of moisture is precipitated as *rain or dew*. *Humidity* refers to the amount of watery vapor in air; ***relative humidity*** is the degree of approach to saturation at any given temperature, while ***absolute humidity*** is the actual weight of the moisture in a given quantity of air.

The impurities of air with which we have to deal in dwellings are dust and bacteria, organic matter, and undue proportion of carbonic acid. The organic matters are particles of epithelium and the volatile products from the lungs and skin, from unclean mouths, noses, and the intestinal tract; in hospitals there are also pus cells from suppurating wounds, and the bacteria of infectious diseases. The effects of overcrowding and vitiated air are well known; immediately they are headache, dizziness, and loss of appetite; when long continued, there is loss of bodily vigor and diminished resistance to disease.

Besides these indirect effects of vitiated air many diseases are directly caused by the inhalation of bacteria from the air; among the most important air-borne diseases are tuberculosis, pneumonia, erysipelas, and possibly the eruptive fevers.

The pollution of air in dwellings is caused not only by the exhalations from the human body, but also by the products of combustion in

heating and lighting. It is estimated that an ordinary five-foot gas burner when in use adds to the air of the apartment fully as much carbonic acid, besides other impurities, as one man.

The process by which the vitiated air of dwellings is removed and replaced or diluted by fresh air is known as *ventilation.*

For the maintenance of the human body in a fair degree of health and vigor it has been found that about three thousand cubic feet of fresh air per hour must be supplied each person. The size of the air space which must be provided for each person depends upon the possibility of supplying this amount of air without causing draughts; if the entering air is warm, draughts of course are not felt so much as if it is cold.

As a matter of experience it has been found that even when warmed the air of a room under the most favorable circumstances can not be changed more than three or four times an hour without causing a sensation of draught; so that the *minimum cubic air space per man* should be at least one thousand feet, which with three changes per hour will give the necessary three thousand cubic feet of fresh air; in the tropics the minimum cubic air space should be two thousand feet, with a floor space of not less than one hundred square feet. In computing the cubic air space in a room we multiply the length by the breadth and then by the height of the room, or by twelve if the height is greater than twelve feet. The reason we do not ordinarily count height above twelve feet is because above that height there is very little movement of the air in the room unless there are special arrangements for its change.

The floor space, therefore, should be not less than one-twelfth of the cubic space.

In hospitals, owing to the additional impurities from the sick, four thousand cubic feet of fresh air per man per hour should be allowed, the floor space should not be less than one hundred square feet and the cubic space not less than twelve hundred feet in temperate climates, and 50 per cent more in the tropics.

The agencies concerned in ventilation are diffusion, and gravity or weight. *Diffusion* is not of much value and can not be relied upon alone; the important agent is gravity. Equal volumes of air of the same temperature and under the same pressure have equal weights; now if one of the volumes is heated it expands and becomes lighter, and being surrounded by heavier air, rises, or rather is forced up,

by the sinking of the heavier air, and thus currents are produced. When the air in a room is heated by fire, lights, or even the human body, it becomes lighter, and the heavier outside air forces itself in through all the openings and crevices, at the same time forcing the lighter air out, thus effecting a certain amount of ventilation.

Unequal temperatures in masses of air outside dwellings give rise to winds, and winds aid ventilation in two ways: First, by *perflation*, or blowing through a room when the windows are open, and second, by *aspiration* when it blows across chimneys or flues.

Ventilation of a dwelling is said to be either *natural* or *mechanical;* natural when we trust to the forces of nature, merely providing the

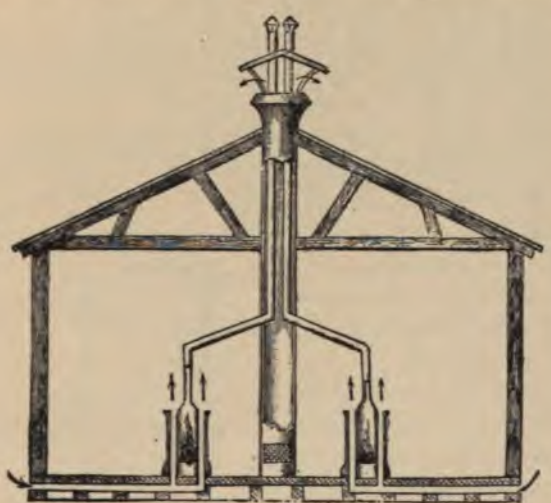

FIG. 225.—Heating and Ventilation by Jacketed Stove.

necessary entrance and exit openings, together with heat if required; mechanical when the air is forced in or drawn out by fans or other mechanical means.

In any system it is necessary to remember that it requires two openings to secure ventilation; if only one opening is provided, the incoming and outgoing currents interfere with each other and ventilation fails. This is well illustrated by the familiar experiment of burning a candle inside of an unstoppered bottle; if the opening into the bottle is divided into two parts by a partition, the candle will burn, because the air currents pass up one side of the partition

and down the other without interference; if the partition is removed the light goes out.

Ventilation in summer or in hot climates is largely a matter of the action of winds, because the temperature of inside and outside air is practically the same, so that we merely leave doors and windows open, and provide special openings in the ridge or under the eaves for the escape of the heated air in the upper parts of the building. Or fans are provided to keep the air in motion; and such devices as the punkah or electric fans.

In winter the subject of ventilation is so intimately connected with that of heating that it is well to consider the latter before going into details of the arrangements for ventilation.

In the military service the methods for heating are practically confined to stoves and furnaces in the older buildings, hot water in the new hospitals, and steam in the new barracks.

Stoves are of very little value in assisting ventilation unless special arrangements are made with that end in view. This may be done by partially surrounding the stove from the floor to the level of the top of the stove by a sheet-iron jacket, and admitting fresh air under the stove from an air-shaft; if in addition to this the stove pipe is made to heat an extracting shaft, opening preferably at the floor level, ventilation may be very materially assisted (Fig. 225). Heating stoves in use should always have a pan of water on them to maintain the proper moisture of the air.

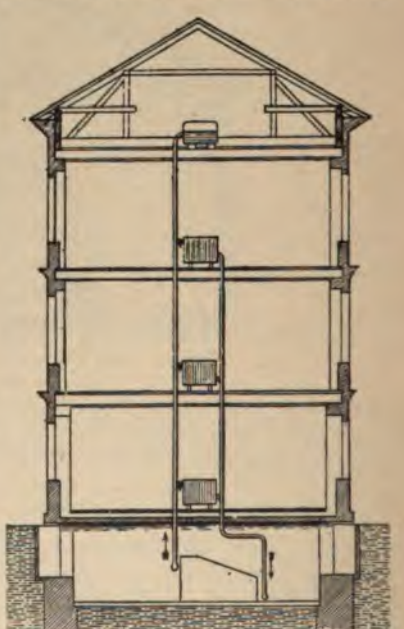

FIG. 226.—Heating by Hot Water. Low pressure.

Furnaces are very valuable ventilators; fresh air is brought to the dome of the furnace by an air shaft, heated, and delivered, where required, through tin tubes.

In hot-water heating there are two systems, *low pressure* and *high pressure*. In the *low-pressure* system, which is that used in the army hospitals, a small, open tank

is provided at the highest point of the system to allow for expansion and the escape of gases. The circulation of the water is due to the difference in weight of the columns of hot and cold water. The water is heated in a boiler in the basement; from the top of the boiler rises a *main*, with branches to all parts of the building; these branches terminate in *radiators*, and from the bottom of each radiator a *branch return* comes off, the branch returns uniting to form a *main return*, which empties into the lower part of the boiler. As the water in the boiler becomes heated it grows lighter, and the

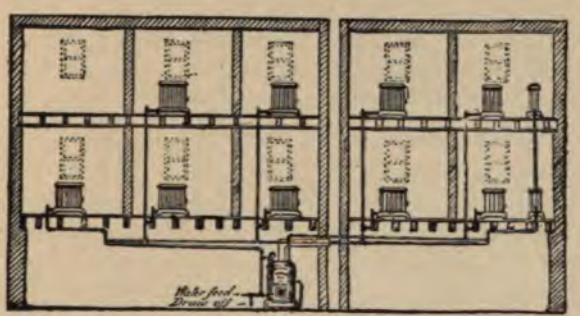

FIG. 227.—Heating by Steam. Low pressure.

heavier water in the returns falls and forces up the hot water, thus effecting a *circulation* (Fig. 226).

In the *high-pressure* system the pipes are completely closed; hence there is some danger of explosion, but the water can be made hotter and circulation is more rapid.

Steam heating is the same in principle as the low-pressure hot-water heating, only steam is used instead of water, and the pipes constitute a closed system (Fig. 227).

Radiators heated by either steam or hot water may be placed in the room to be heated without any connection with the outside air; this is known as the *direct system;* or they may be placed in the basement or some other room, enclosed in a sheet-iron box connected with a fresh-air shaft, the warm air being then conducted to the room, the *indirect system;* or the radiator may be placed in the room to be heated and the fresh air brought directly in under it and allowed to pass up between the pipes so as to be warmed, the *direct-indirect system;* the last is that commonly used in hospitals and barracks (Fig. 228).

When no special arrangements have been made for ventilation a useful and simple device is to place a strip of board under the lower sash, so that air can enter between the sashes and be directed upward

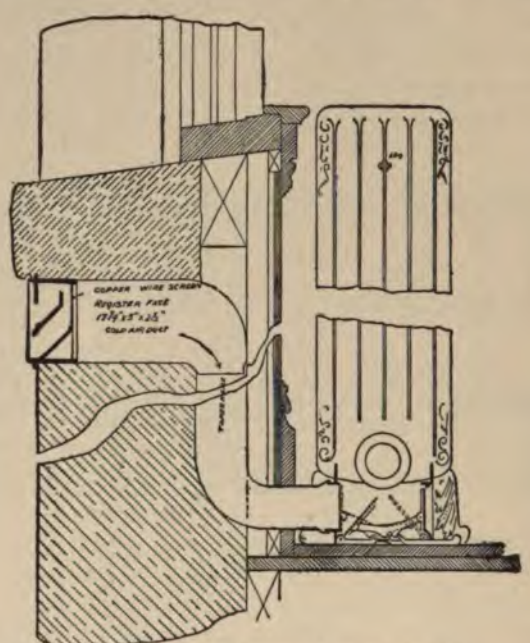

FIG. 228.—Heating by Direct-Indirect Method.

(Fig. 80); or to pull down the upper sash and place a board sloping down over the opening left above (Fig. 81); air will enter between the sashes and escape above.

The best simple test of the efficiency of ventilation is to notice the odor on coming into the room from the outside air; if it is stuffy and close, ventilation is imperfect.

CHAPTER III

THE DISPOSAL OF WASTES

THE organic, dangerous wastes which it is necessary to dispose of in such a manner as not to invite disease are *night-soil* (urine and feces), *slops,* and *garbage;* the first is by far the most dangerous, containing, as it often does, the bacteria of disease. The arrangements for the reception of the night-soil may be pits, pans, or water-closets.

Pits are the most objectionable because they pollute the soil, may infect the water supply, and permit the access of flies, which may carry disease germs on their feet and bodies from the pits to the kitchens and barracks and there infect the food and drink.

Pans, usually used in connection with dry earth to cover and deodorize the feces, are little better than pits. They are open to the same objections, except that soil pollution from accidental spilling is not so marked; in addition they have to be emptied, thus affording another opportunity for scattering infection and creating a nuisance.

Water-closets are best. They may discharge into cess-pools, or into sewers. *Cess-pools* are excavations in the ground which may or may not have a waterproof lining; if they do not have such a lining they are known as *leaching cess-pools.* Cess-pools are objectionable for the same reason as pits and pans.

Sewers are the pipes or channels which carry off the liquid wastes; the wastes themselves are known as *sewage.*

Water-closets and all plumbing fixtures in dwellings empty through short branches into a vertical iron pipe known as the *soil pipe,* and this in the basement empties into a more or less horizontal iron pipe called the *house drain,* and finally the house drain beyond the walls of the house terminates in the *sewer.* The arrangement of the house drainage system is well shown in Fig. 229.

Traps are used on all fixtures, and these traps are usually *vented* to prevent siphonage. The purpose of the trap is to supply a water seal to prevent sewer gas from getting into the dwelling; the three-quarter S-trap is the type (Fig. 230). The *flask trap* used by the Quartermaster's Department for lavatories and sinks is practically the same as an S-trap in its interior arrangement. In yards and

basements where the flow of water is intermittent a particular type of trap known as the *bell trap* is generally employed (Fig. 231); the objection to this trap is that in order to be efficient both the cover and the water seal must be in place, while as a matter of fact the one is often misplaced and the other soon lost by evaporation. A much better type of trap is shown in Fig. 232.

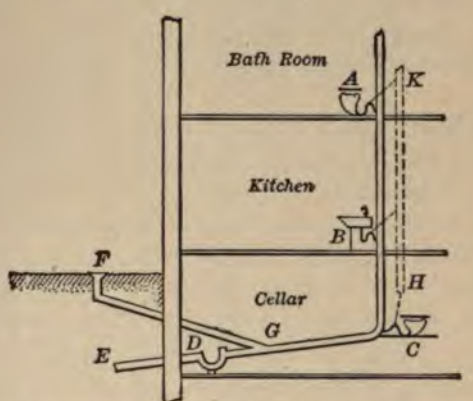

FIG. 229.—House Drainage. *A, B, C,* Plumbing fixtures; *D,* disconnecting trap; *E,* branch sewer; *F,* ventilation opening; *G,* house drain; *K, H,* vent pipes connected by dotted lines with each trap.

Sewage is disposed of by discharging into cess-pools, into running streams, upon sewage farms, and by the bacterial purification methods.

The purpose of the bacterial purification systems, which are now being used in the army to a considerable extent, is to liquefy and purify the sewage so that it may not unduly pollute the streams into which it is discharged. They consist essentially of two parts, a closed tank in which the bacteria which work in the absence of air liquefy the organic solid matters, and a series of filter beds in which the nitrifying or air-using bacteria continue the purification until the sewage should emerge as a clear, colorless liquid like water.

Garbage is best disposed of by burning in a crematory which is usually in operation in all the larger posts.

In the field the disposal of wastes, especially excreta, becomes a matter of greatest importance and considerable difficulty.

Abundant experience has proven that whenever large bodies of soldiers are collected together typhoid fever is sure to be introduced

by some one, and that, unless the command is vaccinated and proper disposal made of excreta, the disease will spread through the agency of infected water, food, bedding, clothing, soil, dust, or flies.

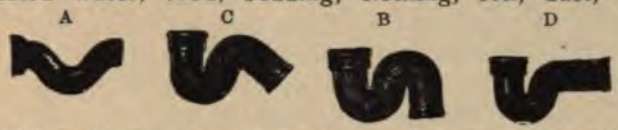

FIG. 230.—Different Forms of Traps. *A*, Running trap; *B*, S-trap; *C*, ¾ S-trap; *D*, ½ S-trap.

Latrines for the men are always located on the opposite side of the camp from the kitchens, generally one for each company unit and one for the officers of a battalion or squadron. They are so placed that the drainage or overflow cannot pollute the water supply or camp grounds.

FIG. 231.—Bell Trap.

When the camp is for one night only, straddle trenches suffice. In camp of longer duration, and when it is not possible to provide latrine boxes, as for permanent camps, deeper trenches should be dug. These may be used as straddle trenches or a seat improvised. When open trenches are used the excrement must be kept covered at all times with a layer of earth. In more permanent camps the trenches are not over 2 feet wide, 6 feet deep, and 12 feet long, and suitably screened. Seats with lids are provided and covered to the ground to keep flies from reaching the deposits; urinal troughs discharging into the trenches are provided. Each day the latrine boxes are thoroughly cleaned, outside by scrubbing and inside by applying when necessary a coat of oil or whitewash. The pit is burned out daily with approximately one gallon oil and fifteen pounds straw. When filled to within two feet of the surface, such latrines are discarded, filled with earth, and their position marked. All latrines and kitchen pits are filled in before the march is resumed. In permanent camps and cantonments, urine tubs may be placed in the company streets at night and emptied after reveille.

FIG. 232.—Improved Yard Trap.

The proper disposal of garbge and stable refuse in camps is also a matter of importance, otherwise they pollute the soil and become a breeding place for swarms of flies; everything which is combustible must be burned; what can not be burned must be buried.

The burning may be done in the kitchen fire, or the solid garbage may be mixed with more combustible matter such as straw or manure, saturated with petroleum and burned. Manure should be burned in the same way as far as practicable.

In more permanent camps crematories should be provided. The following crematory has proved very effective in practice.

Fig. 233.—Crematory—Vertical Section. *A A*, Ground level.

At some convenient spot at the rear of the camp, a circular pit is dug three feet deep and fifteen feet in diameter. The bottom is covered with loose stones to the depth of fourteen to sixteen inches. On this is built a circumferential wall to the height of one foot above the original ground level, and the excavated earth is packed against it, clear to the top so as to provide a sloping approach and thereby prevent surface water gaining access to the pit. A pyramid of large stones, four or five feet high, occupies the center. This feature is essential to provide central draft and steady fire.

The bottom stones receive the liquid portions of the garbage without affecting the fire, and the heated stones soon evaporate and dissipate it. The solid portions are soon desiccated and become fuel. Care should be exercised to empty the garbage into and not around the crematory.

The following rules for the sanitation of camps sums up the whole subject:

(*a*) When practicable, camps should be established on high and well-drained ground not previously occupied.

(*b*) Men should not lie on damp ground. In temporary camps and in bivouac they raise their beds if suitable material, such as straw, leaves, or boughs, can be obtained, or use their ponchos or slickers. In cold weather and when fuel is plentiful the ground may

be warmed by fires, the men making their beds after raking away the ashes.

(*c*) Tent walls are raised and the bedding and clothing aired daily, weather permitting.

(*d*) In camps of permanence excreta should be disposed of by sewers or incinerators.

(*e*) All kitchen refuse should be promptly burned or buried, and perfect sanitary police maintained.

(*f*) The water supply is carefully guarded. When several commands are encamped along the same stream this matter is regulated by the senior officer.

If the stream is small, the water supply may be increased by building dams. Small springs may be dug out and lined with stone, brick, or empty barrels. Surface drainage is kept off by a curb of clay.

When sterilized water is not provided, or when there is doubt as to the purity of the water, it is boiled twenty minutes, then cooled and aerated.

(*g*) The discharges of patients with typhoid fever, camp diarrhea, or cholera should always be disinfected at once with a solution of phenol (5 per cent) or of chloride of lime (six ounces to the gallon of water), or with milk of lime, made from fresh quick-lime.

(*h*) The diseases just mentioned are frequently communicated to soldiers in camp through the agency of flies, which swarm about fecal matter and filth of all kinds, and directly convey infectious material, attached to their feet or contained in their excreta, to the food which is exposed while being prepared at the company kitchen or while being served in the mess tent. The water supply may be contaminated in the same way, or by surface drainage. Infection is also often carried on the hands and shoes. It is for these reasons soldiers are required to wash their hands before meals and after visiting the latrines, and that all kitchens and mess shelters should be screened to exclude flies.

(*i*) If it can be avoided, marches should not be made in the hottest part of the day.

(*j*) When called upon for duty at night or early in the morning a cup of hot coffee should be taken.

(*k*) It is unsafe to eat heartily or drink freely when greatly fatigued or overheated. If alcoholic drinks are used at all, such use

should be postponed until after the day's march and preferable in conjunction with the evening meal.

(*l*) Ripe fruit may be eaten in moderation, but green or over-ripe fruit will give rise to bowel complaints. Food should be thoroughly cooked and free from fermentation or putrefactive changes.

(*m*) In decidedly malarious localities from three to five grains of quinine should be taken three times a day as a prophylactic, but the taking of quinine as a routine practice should only be recommended under exceptional circumstances.

The best safeguard against malaria is, however, the protection of the body against the bites of infected mosquitoes. To this end mosquito nets should be used whenever available in malarial localities or seasons, and if not available the skin should be as far as possible covered during sleep.

(*n*) Light woolen underclothing should be worn, and when a soldier's clothing or bedding becomes damp from exposure to rain or heavy dews the first opportunity should be taken to dry it in the sun or by fires.

CHAPTER IV

DISEASE PREVENTION

In chapter XIII of the section on "Nursing" the infectious diseases have already been discussed as far as the prevention of their spread in posts is concerned.

While there are no diseases entirely peculiar to camp life, there are certain diseases which are specially apt to become epidemic under the more crowded conditions which necessarily prevail in camps.

Among the more notable of these diseases are typhoid fever and malarial fevers, diarrhea and dysentery, the eruptive fevers, bronchial troubles and rheumatism, and in certain climates yellow fever and cholera.

Typhoid fever. To prevent typhoid fever in the field all soldiers should be vaccinated with the typhoid prophylactic; in addition *all* urine and feces must be disinfected; soil pollution must be prevented; flies must be destroyed; drinking water must be boiled; men must not be allowed to bathe in polluted water lest they get it into their mouths; in permanent camps the kitchens and messes must be screened against flies and all food protected from bith flies and dust.

Flies breed in decayed organic matter, especially in stable manure, which should, therefore, never be allowed to accumulate in camp or garrison. In their reproduction flies pass through the stages of ovum or egg, larva or maggot, pupa, and adult. They carry not only typhoid fever but also cholera, tuberculosis, and probably other diseases. Besides the common fly which carries these diseases on its feet and body there is a biting fly, known as *tsetse*, which transmits *sleeping sickness* and other *trypanosome diseases*, by biting, in the same manner as a mosquito transmits malaria.

Malarial fevers. We have seen that malaria is spread in one way only, that is by the bites of the *anophelinæ* mosquitoes which have previously bitten a human being who has malaria. As protection against malaria involves mosquito destruction, it is necessary to learn something about the life history of mosquitoes.

Though all mosquitoes are annoying, only three kinds, as far as we know, carry disease; these are *the anophelinæ,* which carry malaria; *culex fatigans,* which carries dengue and in certain localities in the tropics a blood worm (*filaria*) which causes *elephantiasis;* and *ædes calopus,* which carries yellow fever.

It is the female mosquito only that bites, and therefore the female only which conveys disease. *Ædes calopus* (the yellow-fever mosquito) is especially a day biter, and where mosquitoes are found biting in the daytime they are apt to be of that variety. Then again *ædes calopus* is the blackest mosquito, and is beautifully marked with silver bands on the legs and body; a lyre-shaped silver mark on the back is characteristic and identifies *ædes calopus* at once. This mosquito is of medium size (Figs. 234, 235).

FIG. 234.—Ædes calopus, male.

The *anophelinæ* (the malarial mosquito), Fig. 236. differ from culex and stegomyia in having palpi as long as the proboscis in the female: this mosquito differs also from the other two in that the body and proboscis of the *anophelinæ* form one straight line, while the other mosquitoes are humpbacked. The resting position of the *anophelinæ* is nearly vertical to the surface, while that of *ædes calopus* and *culex* approaches the horizontal (Fig. 237).

The males of all mosquitoes are distinguished from the females by the fact that the former have feathered antennæ (woolly heads), while the latter have not (Fig. 247).

The yellow-fever mosquito is essentially a domestic or house mosquito; that is to say, she breeds in small collections of water such as are found about a house, and does not stray far from home. *The malarial mosquito* is a rural or country insect; breeds in large

pools, the still edges of running streams, irrigating ditches, etc., and is found far from human habitations.

When one of these mosquitoes bites a person afflicted with the disease which she is capable of carrying, she sucks a little blood and with it the germs of the disease. After a week or two these germs reproduce themselves in the mosquito, migrate to her salivary glands, and she then becomes capable of infecting other persons. If she now bites such a person, she injects into his blood with her saliva some of the germs, and after a variable period, known as the *period of incubation,* that person is usually taken down with the disease.

FIG. 235.—Ædes calopus, female.

FIG. 236.—Anopheles maculipennis (quadrimaculatus), female.

The measures to be taken to prevent such diseases are *destruction of mosquitoes, protecting the mosquitoes against infection by screening infected persons* — and in the case of malaria destroying the germs in their blood by the use of quinine; *protecting well persons from infection by the use of screens and nets,* and in the case of malaria, by the use of quinine to render the blood insusceptible to infection.

Mosquitoes breed only in water, but very little water is required for the purpose. The female deposits her *eggs* to the number of 40–400 upon the surface of the water, and after a period of

twenty-four hours to two or three days they hatch, becoming *larvæ* or *wiggle-tails;* the larval stage lasts one or two weeks until the *pupæ*

FIG. 237.—Resting posture of mosquitoes: 1 and 2, Anopheles; 3, Culex Pipiens.

form; after two to five days more the pupal shells split and the *imagos* or *adult insects* emerge (Figs. 240 to 246).

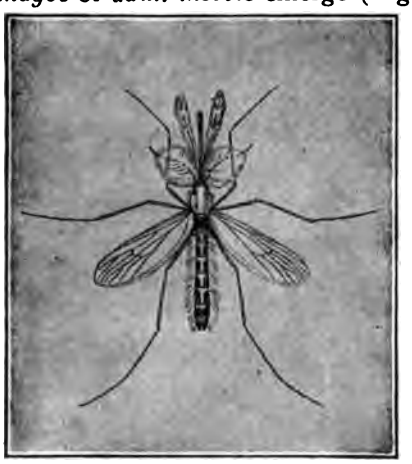

FIG. 238.—Culex pungens, male.

The entire transition from egg to adult insect requires from ten days to two or three weeks.

Any collection of water, provided it is moderately still, answers the mosquito for breeding purposes. They breed in marches, ponds, ditches, rain barrels, cisterns, gutters, watering troughs, hoof-prints, old tin cans, in fact anything capable of holding water. By allowing no unprotected water collections we prevent mosquito breeding. This is accomplished by draining and filling, and by removing all small articles capable of holding water. Collections of water that can not be removed should be closely covered and screened, or else oiled with petroleum, about an ounce to each fifteen square feet of surface, the *petrolizing* being repeated about once a week.

FIG. 239.—Culex pungens, female.

FIG. 240.—A raft of Culex ova.

FIG. 241.—Patterns assumed by Anopheles ova.

FIG. 242.—Egg. Anopheles maculipennis (quadrimaculatus).

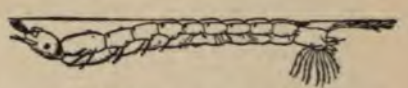

FIG. 243.—Larva of Anopheles mosquito.

FIG. 244.—Larva of Anopheles maculipennis (quadrimaculatus).

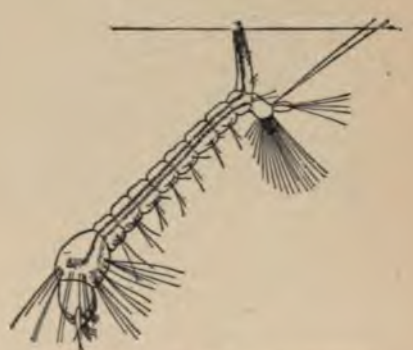

FIG. 245.—Larva of a Culex mosquito.

Adult mosquitoes may be destroyed by fumigating with sulphur or pyrethrum in the closed apartment, using about one pound to the thousand cubic feet of air space; if pyrethrum is used the mosquitoes are only stupefied and must be subsequently swept up and burned.

Other measures for destroying mosquitoes are the clearing away of all vines, brush, tall grass, and undergrowth; such conditions do not breed mosquitoes, but they give them shelter against the winds, which would otherwise blow them away.

In the tropics the natives, especially the children, often carry malarial parasites in the blood, even though they show no sign of the disease, therefore camp should not be made in native villages and natives should not be allowed about the barracks.

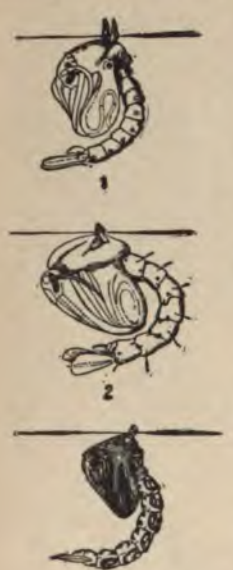

FIG. 246.—Pupæ: 1, Culex; 2, Anopheles; 3, Ædes Calopus.

In the field it is usually impracticable for soldiers to sleep under mosquito nets, but where malaria prevails a considerable degree of protection may be secured by requiring each soldier to wear gauntlets and a small head-net while asleep or on guard.

Yellow fever resembles malarial fever in its method of spread, and in the measures of prevention except that quinine has no value in prevention and is harmful in treatment. Yellow fever differs from malarial fever in that its course is always acute, the fever seldom lasting longer than five to seven days, and especially in that an attack affords almost complete protection against a second, while in malaria one attack seems to predispose to others, and the infection of malaria may remain in the blood indefinitely.

Diarrheas which are so prevalent among troops in the field are due to a variety of causes. Infection of food by flies, faulty cooking, overeating, improper food, particularly that purchased from camp venders, exposure to chilling, especially at night, and impure water are common causes. Many diarrheas are probably merely symptomatic of graver disorders such as typhoid fever or dysentery.

The proper preventive measures are the supply of proper food

well cooked and protected from flies, the suppression of camp venders, the furnishing of sterilized drinking water, and the general use of woolen undershirts sufficienly long to cover the abdomen; such a shirt is much better than an abdominal band.

The *dysenteries* are of three types, the *catarrhal,* due to exposure and improper food; the *bacillary* or *epidemic* form, and the *amebic* or *tropical* form of dysentery; the last two forms are infectious and the measures of prevention are the same as in typhoid fever.

The *eruptive fevers* are especially apt to occur and become epidemic when large numbers of young men are brought into the intimate contact of the camp; the general method of preventing their spread has been discussed, but it is necessary to describe here in detail the special and most important preventive measure against *smallpox,* viz., *vaccination.*

Vaccination is the process of inoculating a person with *vaccine virus,* producing the condition known as *vaccinia.*

Vaccinia is an eruptive disease of the cow, the virus of which when inoculated in man produces a local pock with constitutional disturbance, and protects against smallpox; vaccinia is probably smallpox of the cow, but it has not been proven that such is the case.

FIG. 247.—Heads of mosquitoes: 1 and 2, male and female Culex pungens; 3 and 4, male and female Anopheles; 5 and 6, male and female Ædes Calopus.

Bovine vaccine virus, that is virus from the calf, is now used to the exclusion of human virus on account of the danger with the latter of transmitting human diseases.

Vaccine is usually provided either on bone points or in capillary tubes; in either case the virus is preserved by glycerin, but it gradually loses its power and becomes inert; it should always be kept in a dark, cool, dry place.

In performing vaccination it should be borne in mind that it is a surgical operation and that the same care must be taken to prevent infection as in any other operation. The hands of the operator, the surface operated upon, and everything coming in contact with either should be as nearly sterile as possible; at the same time it must be remembered that active antiseptics will destroy the vaccine.

"The skin at selected site must be clean; antiseptics are not necessarily employed; should they be used they must be washed away with sterile water that the activity of the virus be not destroyed. Washing with warm water, followed by alcohol, is usually sufficient, the alcohol being permitted to evaporate before proceeding. Scrubbing with soap and water is necessary for a dirty skin, but needless irritation of the skin is to be avoided.

"Incision is the method of choice and it should be made with the point of a sterile needle, producing a 'scratch.' A sterile scalpel may be used, but is more likely to cause bleeding. The incision or scratch should preferably not draw blood. There should be at least two incisions, three-quarters of an inch long and one inch apart; after exposure to smallpox four incisions will be made. The virus is then placed upon the abraded surface and gently rubbed in, unnecessary irritation being avoided."

"The wound is allowed to dry thoroughly and can be left without dressing, though several layers of gauze may be applied with adhesive plaster. Any dressing that retains heat and moisture is bad. Shields will not be used."

If a vaccination takes properly, about the third to the fifth day after the operation a small *papule* or pimple will be noticed at the spot scarified; by the seventh day the papule has become a *vesicle* or blister depressed in the center; by the eighth or ninth day the vesicle has become full size and an *areola* or red blush appears around it; at the same time the glands under the arm become a little swollen and painful, and there may be some fever and general discomfort; on the eleventh or twelfth day the redness and soreness begin to disappear, the contents of the blister become cloudy, and it begins to dry up, forming a scab which drops off about the twenty-fourth day, leaving a characteristic pit or pits which is the sign of a successful vaccination.

Vaccination does not always follow this typical course; sometimes the whole duration of the inflammation is much shorter, and the pit

or pock is not so marked; this is especially apt to be the case in revaccination. Sometimes, especially when the operation has been carelessly done or the vesicle is prematurely broken, violent inflammation results, with sloughing and ulceration. Occasionally the vaccinia is generalized, vesicles forming at other points on the arm, or even over the entire body.

Cholera (*Asiatica*) runs its course very acutely in typical cases, oftentimes terminating fatally in twenty-four hours. It is characterized by violent vomiting and purging — the discharges soon becoming like water — by great prostration and muscular cramps. It must not be forgotten, however, that the only symptom may be an ordinary diarrhea, and that such cases are just as infectious as the severe type. The preventive measures are described on page 254.

CHAPTER V

SANITATION IN THE FIELD

The selection of a camp site will often depend upon military considerations; the essential requirements are wood, water, and grass, and from a sanitary standpoint dryness, elevation, and some protection from winds.

An old camp site should never be occupied because the soil is certain to be polluted and probably infected; outbreaks of typhoid fever and cholera have repeatedly followed the occupation of old sites.

Sites covered with rank vegetation should be avoided, as such vegetation indicates excessive moisture. Open woods are not unfavorable camp grounds, as they afford some protection from sun in summer and winds in winter, but dense woods should never be occupied on account of the dampness, stagnation of air, and decaying vegetation. All underbrush should be removed from camp, but sod should not be disturbed.

Tents, as soon as pitched, must be trenched; if the tent site is covered with grass the grass should be cut or pulled up, because it will die anyway and its decomposition will help to pollute the air; the soil should be well pounded and covered, if practicable, with a layer of ashes or gravel, also well pounded. In permanent camps the tents should be floored, but the floors should be in sections of such size that they can be readily removed for policing and sunning the ground underneath. No eatables should ever be allowed in tents other than the kitchen and mess. The interval between tents in the same row should be at least equal to the height of the ridge.

All tents are crowded, not more than about eighty cubic feet of air space being usually allowed; therefore the greatest attention should be paid to ventilation; dry canvas allows some penetration of air, but moist canvas is practically impervious. Tent walls should always be kept looped up in summer and even in winter whenever possible. Every three or four days the tents should be removed to the adjoining area and turned inside out, so that the interior may be sunned at the same time as the tent floor. About once in ten days the entire

camp should be removed to at least a sufficient distance to entirely clear the old site.

As the ground is always more or less damp and removes the heat of the body rapidly, a soldier should never sleep directly upon it if it can be avoided; if nothing else is available, his poncho should be placed under him, but if possible he should raise himself above the ground by the use of hay, straw, evergreen boughs, or improvised bunk. Bedding should be removed and aired daily, being hung upon lines if practicable.

The police of the camp within and without the tents should be thorough. The disposal of garbage has already been described; at night men who wish to urinate will often do so just outside the tent rather than go to the distant sink; therefore urine tubs containing a disinfectant solution should be placed in the company streets every night, and removed in the morning; their position should be indicated by a lantern; the position of the sinks should also be indicated by a lantern on dark nights.

The water supply of the camp is of the greatest importance; as a general rule all water supplies of inhabited regions in the tropics must be regarded as infected and require boiling before use; the same may be said of surface waters, and shallow wells in other climates.

As soon as a camp is occupied a guard is placed over the water and proper places designated for bathing, washing of clothing, watering animals, etc.

Among the minor but still important troubles incident to field service are foot-soreness, chafing, and occasionally body lice.

To avoid *foot-soreness* the first requisite is a properly shaped and fitted shoe; the next is clean feet and clean, dry socks. No other shoe than that supplied by the Quartermaster's Department should ever be worn. The feet should be carefully washed at the end of the march, thoroughly dried, and the socks changed, the used pair being washed or at least sunned and dried for the next day Toe-nails should be cut square across and not too short; if there is a tendency to soreness, anointing the feet, especially between the toes, with vaseline, is effective; in the absence of vaseline, *foot powder* may be dusted on the feet and into the socks; vaseline is better than powders. If there are blisters they should not be opened unless they are so large that they would break in walking; cover each

a mall piece of adhesive plaster; if the blister must be opened make the smallest opening possible with a needle or pin and gently press out the fluid. If the skin is rubbed off cover with plaster. Hard corns should be trimmed close or scraped with a piece of glass; soft corns require treatment by a medical officer.

Chafing is especially apt to occur in the crotch or other joint flexures; the best preventive of chafing and body vermin is cleanliness. Take a bath daily, but if water is scarce at least wash the feet, hands, arm-pits, and genitals. Should chafing occur use vaseline or foot powder.

When *lice* are found on the body cut the hair of the parts close and apply blue ointment, or solution of corrosive sublimate 1:500. The underclothes must be boiled, or washed in sea water.

CHAPTER VI

PERSONAL HYGIENE

THIS subject has been dealt with generally under other headings, but it is necessary to cover a few points here which have not been included elsewhere.

The first requisite for good health is *cleanliness of person and clothing;* the former is not usually difficult to obtain, but the latter often presents serious obstacles in the field. Every opportunity should be taken to wash the underclothing; if very dirty it should be soaked for awhile before scrubbing; woolen articles should be rinsed and scrubbed as little as possible, as such treatment renders them hard and causes shrinking. When water is not available the underclothing should be changed, dried in the sun, aired, and beaten.

In the tropics a contagious skin disease known as *dhobie itch* is of frequent occurrence; it is usually due to uncleanliness and infected underwear. Besides treatment of the disease it is necessary to boil the underwear to get rid of the infection.

Particular attention should be paid to the *teeth,* a tooth brush being used twice a day; ulceration of the gums, so prevalent in the tropics, may be thus avoided, but if it occurs the soldier should report to his medical officer for treatment.

The *hair* should be kept short and frequently washed.

The purpose of *clothing* is to protect the body from the vicissitudes of weather; from heat in summer, cold in winter, and from the chilling effects of rain and wind.

The fulfillment of these purposes depends upon the nature of the material, its texture, color, its heat-conducting and water-absorbing properties.

The materials of which clothing is made are wool, cotton, and linen.

Wool is a poor conductor of heat and a good absorber of moisture; hence it keeps in the heat of the body in winter and keeps out the heat of the sun in summer; by its property of absorbing and condensing moisture, thus setting free its latent heat, it prevents

chilling of the body when prespiring after exertion; these properties render it suitable for undergarments in both summer and winter, and for outer garments in winter.

Cotton and linen are good conductors and poor absorbers of moisture, qualities which adapt them for use in outer garments in hot weather.

The *color* of outer garments has no influence on the temperature of the body except in the direct rays of the sun; black and dark colors absorb the direct sun's rays the most, while white and yellow reflect them most.

Besides color and material, *texture* has an important influence on the power of conducting heat; the more loosely woven a material is the more air there is in the texture, and as air is a very poor conductor, the warmer the material. Hence, the warmth of fur and feathers. Impervious stuff, such as rubber and to a less degree leather, keep out winds and are warm for that reason.

Venereal diseases constitute one of the greatest dangers to which the soldier is exposed; their hospital management is discussed on page 255; but it is necessary to look at them from the point of view of personal hygiene. Ordinarily regarded by the soldiers as matters of trivial importance, gonorrhea, chancroid, and syphilis are so far-reaching in their effects that these effects should be thoroughly understood.

Gonorrhea or clap, besides the immediate discomfort and inconvenience caused by it, is often followed by swollen testicle, stricture of the urethra, and stricture of the spermatic ducts so that the semen cannot escape, and the man becomes sterile; by a very severe form of rheumatism, inflammation of the bladder and kidneys, and occasionally septicemia and death. Getting a little of the gonorrheal pus into the eye from unclean fingers or towels produces a destructive inflammation often resulting in blindness.

In *syphilis* the blood is infected, and while the disease is curable one can never be certain that the cure is permanent.

The first stage is the chancre, the second the skin eruptions and the mucous patches, while in the third we have the terrible destructive affections of the bones, internal organs, nervous system, and blood-vessels. Sometimes the nose is eaten away or caves in, the palate is destroyed, the voice lost, and paralysis, locomotor ataxia, and aneurism are among the later results. Add to this that

if the syphilitic marries he is liable to infect his wife and very apt to beget syphilitic children, and the gravity of the disease may be seen.

The probability of contracting some form of venereal disease in illicit intercourse is very great; about a third of all women prostitutes are infected; *all* are certain to become so in course of time.

The only certain protection against veneral disease is absolute avoidance of impure intercourse. This involves continence in the unmarried soldier. There is a widespread impression that continence is harmful to the young and vigorous man; nothing is further from the truth. Nature has provided emissions for the discharge of an undue accumulation of seminal fluid, and their occasional occurrence does no harm.

As *alcoholism* leads to sexual indulgence the two conditions should be considered together. The healthy man does not require alcohol in any form; though it is occasionally taken habitually for long periods without any apparent bad results, there is no doubt that even in such cases there is diminished resistance to disease. Though the temporary effect of alcohol is stimulating this effect is promptly followed by diminished resisting power to both heat and cold.

The weight of evidence is that alcohol is particularly harmful in the tropics, and many of the cheap native forms of crudely distilled liquors which are obtainable there have specially poisonous effects.

To guard against the special diseases of the tropics one of the most important general rules is to strictly avoid all native prepared foods and drinks; the method of their preparation is usually filthy in the extreme, and they are frequently infected with the germs of disease.

Native fruits, in good condition, neither unripe nor over-ripe, may be taken in moderation, but the outerskin should always be removed, or thoroughly washed in pure water.

The sun, in the heat of the day, should be avoided when possible, and when in the sun the back of the head and neck should be protected by a handkerchief or piece of muslin attached to the back of the cap or hat. The Japanese soldiers use such a flap in two pieces so as to allow free passage of air.

At night, and especially toward morning, chilling of the abdomen should be prevented by wearing a long undershirt or by throwing a blanket over the body.

PART VIII

RIDING, PACKING, AND DRIVING

CHAPTER I

RIDING

WAR Department orders provide that at posts where there are mounted troops the necessary instruction of the hospital corps in riding shall be given by troop or mounted detachment commanders in connection with the instruction of their troops. At other posts, however, the instruction must be given under the direction of medical officers whenever the necessary animals are available. The following course of instruction is taken from the Cavalry Drill Regulations modified to meet the requirements of the hospital corps:

* * * * * * * *

270. The order of instruction indicated may be modified at the discretion of the officer superintending, care being taken to develop the confidence of the recruit by progress suited to his capacity, and which will exempt him as far as possible from falls or other accidents.

During the first few lessons the instructor will devote his attention chiefly to giving to the recruits the proper seat and carriage and to making them self-confident on horseback; he will quietly and patiently correct the faults of each individual as they occur, frequently passing from one to another, and will require by degrees the correct execution of his teachings; these understood and confidence imparted, the positions and motions will then be rigidly enforced.

* * * * * * * *

271. Each mounted drill begins and ends at the walk. *This rule is general.*

272. During the drills the recruits are taught the following rules for the care of horses, until the instructor is satisfied by means of questions that they are thoroughly comprehended:

Never threaten, strike, or otherwise abuse a horse.

Before entering a stall, speak to the horse gently and then go in quietly.

Never take a rapid gait until the horse has been warmed up by gentle exercise.

Never put up a horse brought in a heated condition to the stable or picket line, but throw a blanket over him and rub his legs, or walk him until cool. When he is wet, put him under shelter, and wisp him until dry.

Never feed grain to a horse nor allow him to stand uncovered when heated. Hay will not hurt a horse, no matter how warm he may be.

Never water a horse when heated unless the exercise or march is to be immediately resumed.

Never throw water over any part of a horse when heated.

Never allow a horse's back to be cooled suddenly, by washing or even removing the blanket unnecessarily.

To cool the back gradually, the blanket may be removed and replaced with the dry side next the horse.

The Equipment of the Horse

273. The instructor indicates the different parts and uses of each equipment as a commencement of this instruction.

To Fold the Saddle Blanket

274. The blanket, after being well shaken, will be folded into six thicknesses, as follows: Hold it well up by the two corners, the long way up and down; double it lengthwise (so the fold will come between the "U" and "S"), the folded corner (middle of blanket) in the left hand; take the folded corner between the thumb and forefinger of the right hand, thumb pointing to the left; slip the left hand down the folded edge two-thirds its length and seize it with the thumb and second finger; raise the hands to the height of the shoulders, the blanket between them extended; bring the hands together, the double fold falling outward; pass the folded corner from the right hand into the left hand, between the thumb and forefinger, slip the second finger of the right hand between the folds, and seize the double folded corner; turn the left (disengaged) corner in, and seize it with thumb and forefinger of the right hand, the second finger of the right hand stretching and evening the folds; after evening the folds, grasp the corners and shake the blanket well in order to smooth the folds, raise the blanket and place it between the chin and breast; slip the hands down half-way, the first two fingers outside, the other fingers and thumb of each hand inside, seize the blanket with the thumbs and first two fingers, let the part under the chin fall forward; hold the blanket up, arms extended, even the lower edges, seize the middle points between the thumbs and forefingers, and flirt the outside part over the right arm; the blanket is thus held before placing it on the horse.

The blanket should, if possible, be kept dry and free from sand, caked dandruff, and hairs. It should be frequently shaken out and well switched, if necessary, to restore its pliability and remove dust and hair. In warm weather, when the animal sweats freely, a fresh, clean bearing surface on the blanket should be placed next to the back.

It is not a good plan to dry the sweat-soaked surface of a folded blanket

in the sun and put this dried surface next the back the following morning. Such drying hardens the dandruff mixed with sweat and dust that is always present, and makes this part of the blanket rough and hard. It is preferable to double the sweat-soaked folded blanket on itself, so it will remain moist and soft.

To Put on the Blanket and Surcingle

275. The instructor commands: BLANKET.

Approach the horse on the near (left) side, with the blanket folded and held as just described; place it well forward on his back, by tossing the part of the blanket over the right arm to the off (right) side of the horse, still keeping hold of the middle points; slide the blanket once or twice from front to rear to smooth the hair, being careful to raise the blanket in bringing it forward; place the blanket with the forefinger of the left hand on the withers, and the forefinger of the right hand on the backbone, the blanket smooth; it should then be well forward with the edges on the left side; remove the locks of mane that may be under it; pass the buckle end of the surcingle over the middle of the blanket, and buckle it on the near side, a little below the edge of the blanket.

To Put on the Watering Bridle

276. The instructor commonds: BRIDLE.

Take the reins in the right hand, the bit in the left; approach the horse on the near side, slip the reins over the horse's head and let them rest on his neck; reach under and engage the snap in the right halter ring, insert the left thumb in the side of the horse's mouth above the tush and press open the lower jaw; insert the bit and engage the snap in the left halter ring. The bit should hang so as to touch, but not draw up, the corners of the mouth.

To Unbridle

277. At the command, *unbridle,* pass the reins over the horse's head and disengage the snaps.

The Saddle and Bridle

279. Greatest care will be taken in the fitting of the saddles; sore backs are generally occasioned by neglect, and the men must never be allowed to lounge or sit unevenly in their saddles.

To Saddle

280. For instruction, the saddle may be placed four yards in rear or front of the horse. The stirrups are crossed over the seat, the right one uppermost; then the cincha and cincha strap are crossed above the stirrups, the strap uppermost. The blanket having been placed as previously explained, the instructor commands: SADDLE.

Seize the pommel of the saddle with the left hand and the cantle with the right, approach the horse on the near side from the direction of the croup and *place the center of the saddle on the middle of the horse's back*, the end of the side bar about three fingers' widths behind the point of the shoulder blade; let down the cincha strap and cincha; pass to the off side, adjust the cincha and straps and see that the blanket is smooth; return to the near side,

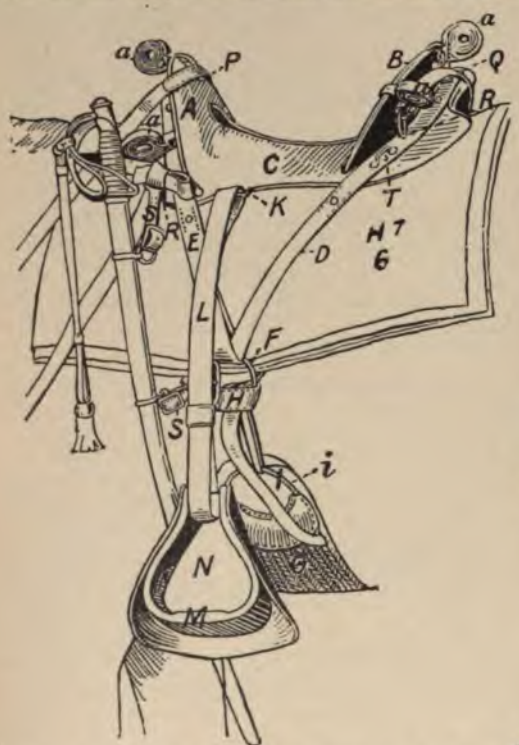

FIG. 248.—Nomenclature of the Saddle. *A*, Pommel; *B*, cantle; *C*, side bar; *D*, *E*, spider (quarter straps); *F*, spider (or girth-strap) ring; *G*, cincha; *H*, cinca strap; *I*, cincha ring; *i*, cincha-ring safe; *K*, stirrup loop; *L*, stirrup strap; *M*, stirrup tread; *N*, stirrup hood; *P*, shield; *Q*, stud; *R*, *R*, rings; *S*, *S*, saber straps; *T*, staple; *a*, *a*, *a*, *a*, coat straps.

FIG. 249.—Nomenclature of the Bridle. Headstall: *A*, Crownpiece; *B*, brow band; *C*, ornament; *D*, *D*, cheek piece; *E*, throatlatch. Bit: *F*, *F*, Mouth piece; *G*, port; *H*, *H*, branches; *I*, *I*, rein rings; *K*, curb strap; *R*, reins. Link: *L*, Link strap; *M*, link snap.

raise the blanket slightly under the pommel arch so that the withers may not be compressed; take the cincha strap in the right hand, reach under the horse and seize the cincha ring with the left hand, pass the end of the strap through the ring from underneath (from inside to outside), then up and through the upper ring from the outside; if necessary make another fold in the same manner.

The strap is fastened as follows: Pass the end through the upper ring to the front; seize it with the left hand, place the fingers of the right between the outside folds of the strap; pull from the horse with the right hand and take up the slack with the left; cross the strap over the folds, pass the end of it, with the right hand, underneath and through the upper ring back of the folds, then down and under the loop that crosses the folds and draw it tightly: weave the ends of the strap into the strands of the cincha.

Another method of fastening the cincha strap is as follows: Pass the end through the upper ring to the rear; seize it with the right hand, place the fingers of the left between the outer folds of the strap; pull from the horse with the left hand and take up the slack with the right; pass the end of the strap underneath and draw it through the upper ring until a loop is formed; double the loose end of the strap and push it through the loop and draw the loop taut. The free end should then be long enough to conveniently seize with the hand.

Having fastened the cincha strap, let down the right stirrup, then the left.

The surcingle is then buckled over the saddle and should be a little looser than the cincha.

The cincha when first tied should admit a finger between it and the belly. After exercising for a while the cincha will be found too loose and should be tightened.

The cincha should not be unduly tightened. Tight cinching causes young animals to rear and even throw themselves. It induces local swellings and galls, by interfering with the circulation, and it teaches all saddle animals to inflate the lungs ("swell themselves") the moment they feel the touch of the cincha. On cold mornings tight cinching causes even old saddlers to buck.

Take up the cincha gently and draw it snugly, then secure it temporarily. Adjust your stirrups and see that they are of equal length. This can be judged by standing in front of the animal and comparing one with the other. It will be found that from the often repeated mounting and dismounting on the near side the stirrup leather of that side will usually be found longer than the other. Having adjusted things generally, return to the cincha and take up the slack that will now be found, draw it snugly but not tightly, and secure it, being careful that there are no wrinkles in the strap and that the cincha itself does not encroach on the quarter strap ring shield. If it does, either the cincha strap is too long on the off side or the cincha is too long. In either event, make the necessary correction at once, if possible. If this correction is not made soon, a gall may be expected.

281. To approximate the length of the stirrup straps before mounting, they are adjusted so that the length of the stirrup strap, including the stirrup, is about one inch less than the length of the arm, fingers extended.

To Unsaddle

282. The instructor commands: UNSADDLE.

Stand on the near side of the horse; unbuckle and remove the surcingle;

cross the left stirrup over the saddle; loosen the cincha strap and let down the cincha; pass to the off side, cross the right stirrup, then the cincha; pass to the near side, cross the cincha strap over the saddle; grasp the pommel with the left hand, the cantle with the right, and remove the saddle over the croup and place it in front or rear of the horse as may be directed, pommel to the front; grasp the blanket at the withers with the left hand and at the loin with the right, remove it in the direction of the croup, the edges falling together, wet side in, and place it across the saddle, folded edge on the pommel.

If in the stable, place the saddle on its peg when taken off the horse.

On arriving in camp and having dismounted, ease off the cincha about 3 inches and change the bearing of the saddle by moving it to rear or front at least an inch. Allow the saddle to remain on the back for ten or twelve minutes, to enable the almost bloodless skin beneath (caused by weight of yourself and pack) and the tired saddle bed muscles to regain to some extent their lost tone, while you busy yourself about the bridle and halter, and the religious duty of closely examining the feet for loose shoes, rocks, nails, bruises, thrush, and interfering sores. Now remove the saddle, turn over the blanket, and let that remain in place until the back has dried.

If any dry spots are noticed on the sweaty skin while the blanket is being turned over, remember they are inflammations of the skin, produced by unequal distribution of weight, and are liable to puff up later if not attended to. Mark their location well, for you are close to the walking stage if you neglect them. When the back is dry, remove the blanket and take care of it. Massage well from front to rear the spots referred to, bathe the saddle bed with clean water, dry it, and let the animal roll if he will. Should small swellings appear, however, keep the blanket in place until a soaking wet gunny sack is procured. Now remove the blanket, massage the swelling vigorously, and put the wet folded gunny sack pack over the back and secure it there. Do not allow the animal to roll if it can be avoided, and keep the pack wet during the night. In the majority of cases the animal will be ready for careful saddling in the morning.

Should you have produced a gall, the place should be bathed and disinfected with creolin or carbolic-acid solution (1 ounce to the quart of water), the spot protected from the flies, cold-packed if necessary, and the animal led until nature effects a cure. Close attention to cleanliness, disinfection, and stimulation of the wound will hasten the process. Use a solution of aloes or alum in water (one-half ounce of either to a pint of water) as a stimulant.

Even with very close attention to saddling, galls may be produced if the rider is not a careful one.

Irrespective of the fit of the saddle and condition of blanket, the things that cause galls and "bunches" most frequently are carelessness in balancing and securing the pack, a lounging, shifting seat, and a sloppy method of handling the reins, inattention to proper cinching, unequal length of stirrups, neglect of adjustment at the halts, the riding of a lame animal, and the galloping of a leg-weary one.

To Put on the Curb Bridle

283. The instructor commands: BRIDLE.

Take the reins in the right, the crownpiece in the left hand; approach the horse on the near side, passing the right hand along his neck; slip the reins over his head and let them rest on his neck; take the crownpiece in the right hand and the lower left branch of the bit in the left hand, the forefinger against the mouthpiece; bring the crownpiece in front of and slightly below its proper position; insert the thumb into the side of the mouth above the tush; press open the lower jaw, insert the bit by raising the crownpiece, with the left hand draw the ears gently under the crownpiece, beginning with the left ear; arrange the forelock, secure the throatlatch, and then the curb strap, taking care not to set them too closely.

284. The mouthpiece, which should fit the width of the horse's mouth, rests on that part of the bars (the lower jaw between the tushes and molars) directly opposite the chin groove; the curb strap should then lie in the chin groove without any tendency to mount up out of it on the sharp bones of the lower jaw. This position of the mouthpiece will be attained for the majority of horses by adjusting the cheek straps so that the mouthpiece will be one inch above the tushes of the horse and two inches above the corner teeth of the mare.

The throatlatch should admit four fingers between it and the throat; this prevents constriction of the windpipe or pressure on the large bloodvessels.

The curb strap should fit smoothly the chin groove, and be loose enough to admit one or two fingers when the branches of the bit are in line with the cheek straps.

285. At the discretion of the instructor, the halter may be taken off before bridling, the reins being first passed over the neck; the hitching strap, if not left at the manger or picket line, is tied around the horse's neck; if the horse be saddled, in the near pommel ring.

To Unbridle

286. The instructor commands: UNBRIDLE.

Stand on the near side of the horse; pass the reins over the horse's head, placing them on the bend of the left arm; unbuckle the throatlatch, grasp the crownpiece with the right, and assisting with the left hand gently disengage the ears; grasp the bit with the left hand, and gently disengage it from the horse's mouth by lowering the crownpiece; place the crownpiece in the palm of the left hand, take the reins in the right hand, pass them together over the crownpiece, make two or three turns around the bridle, then pass the bight between the brow band and crownpiece and draw it snug.

The bridle is hung up by the reins, or placed across the saddle on the blanket.

If the horse has no halter on, unbridle and push the bridle back so that the crownpiece will rest on the neck behind the poll until the halter is replaced.

To Mount (without saddle)

293. 1. PREPARE TO MOUNT. 2. MOUNT.

At the first command, drop the right rein, take two back steps, stepping off with the left foot, at the same time sliding the right hand along the left rein; face to the right. This should place the trooper behind the near shoulder of the horse. Take both reins in the right hand, aided by the left, the reins coming in on the side of the forefinger, forefinger between the reins, the loose end falling over on the off side; place the right hand behind the withers, holding the reins short enough to feel lightly the horse's mouth; place the left hand near the withers, and grasp a lock of the mane, the lock coming out between the thumb and forefinger.

At the command *mount*, spring lightly from the ground and raise the body, keeping it erect, and supporting the weight on the hands; carry the right leg, knee bent, over the horse's back, the weight still borne on the hands; sit down gently on the horse's back, and take one rein in each hand, the reins bearing equally on the horse's mouth.

In the earlier lessons, the recruit may rest the right forearm on the horse's back to enable him to raise the body when mounting.

Position of the Trooper (without saddle)

294. Body balanced on the middle of the horse's back.

Head erect and square to the front.

Chin slightly drawn in.

Shoulders square and well thrown back.

Chest pushed out.

Back straight.

Elbows slightly to the rear of the points of the shoulders.

Forearms horizontal and close to the sides without pressure.

The right rein in the right hand, and the left rein in the left hand, coming in on the underside of the little finger, and coming out over the second joint of forefinger, on which the thumb firmly holds the rein; the other fingers closed on the reins, nails toward the body; reins bearing equally on the horse's mouth; bight (end) of reins falling to the front and on the right side of the horse's neck.

Hands about six inches apart, on a level with the elbows, backs straight up and down and outward.

Buttocks bearing equally on the middle of the horse's back, the seat being as flat as possible.

Legs stretched by their weight alone, the flat of the thighs and knees clasping the horse equally.

Legs from knees down vertical and free.

Feet parallel to the sides of the horse, or as nearly so as the conformation of the man will permit.

Remarks on the Position of the Trooper

Body balanced on the middle of the horse's back, because that is the point where the motion of the horse is least communicated to the rider, and the best weight-bearing position for the horse.

Head erect and square to the front. If not, the body will incline forward or to one side and be unsteady.

Chin slightly drawn in. To prevent the head and shoulders from drooping to the front.

Shoulders square and well thrown back and the chest pushed out. If not, the chest will be contracted and the back curved to the rear.

Back straight. This gives an erect carriage and counteracts the tendency to slouch or droop the shoulders.

Elbows slightly to the rear of the shoulders. To assist in keeping the shoulders back.

Forearms horizontal and close to the sides without pressure. To prevent their being thrown out when the horse trots; if with pressure, the motion of the body will be communicated to the hand and rein.

Buttocks bearing equally, and seat as flat as possible. So that the body will preserve its steadiness.

Flat of thighs and knees clasping the horse equally. To give a firm steady seat.

Legs from knees down vertical and free. That they may be carried to the rear to aid in directing the horse without deranging the seat.

Feet parallel to the horse. To assist in holding the thighs in position.

The body from the hips up should be movable, and should, in a measure, yield to the motions of the horse; from the hips to the knees, immovable and close to the horse; from the knees down, movable.

The arms move freely at the shoulders to avoid communicating the motion of the body to the reins, the hands oscillate slightly with the motion of the horse, but otherwise they are stationary, except to direct the horse.

During the earlier lessons the position of the recruit is necessarily one of constraint.

No man can be said to be a good horseman who has not a firm, well-balanced seat; it is therefore of the utmost importance; it will assist the horse; the want of it will impede the horse's actions, make sore backs, etc.

To Lengthen or Shorten the Reins

295. Bring the hands toward each other: grasp the right rein with the thumb and forefinger of the left hand a short distance from the right thumb; relax the grasp of the right hand, and allow the rein to slip through to get the proper bearing; then close the right hand and replace the hands. With the left rein the positions of the hands are reversed.

To Take the Reins in One Hand

296. To relieve the constraint of the arms by changing their position, as well as to prepare the recruits for the use of the curb bridle, the instructor commands: 1. *In left* (or *right*) *hand.* 2. TAKE REINS.

At the second command, bring the left hand opposite the middle of the body; half open and place in it the right rein, holding both reins as explained for the left rein, except that the little finger separates the reins, the right rein coming in above the little finger; close the left hand and drop the right hand behind the thigh.

To Adjust the Reins

297. Seize the bight with the thumb and forefinger of the right hand partly open the left hand so as to allow the reins to slip through it; raise the right hand until the reins bear equally; close the left hand upon them letting the bight fall over the forefinger and right rein; drop the right hand.

To Retake the Reins in Both Hands

298. The reins being in the left hand: 1. *In both hands.* 2. TAKE REINS.

Half open the left hand, seize with the right hand the right rein, and hold them as previously described.

To Drop and Retake Reins

299. DROP REINS: Drop the reins on the horse's neck near the withers and drop the hands behind the thighs.

TAKE REINS: The trooper retakes the reins and holds them as before dropping them.

To Dismount (without saddle)

300. 1. PREPARE TO DISMOUNT. 2. DISMOUNT.

At the first command, pass the right rein into the left hand, then seize both reins with the right hand in front of the left, forefinger between the reins, and place the right hand on the withers, the reins coming into the hand on the side of the forefinger; let go with the left hand and grasp a lock of the mane in front of the withers, the lock coming out between the thumb and forefinger.

At the command *dismount*, raise the body on both hands, carry the right leg, knee bent, over the horse's back without touching it; bring the right leg near the left and come lightly to the ground on the balls of the feet, bending the knees a little; face to the left, drop the right rein, step to the front, sliding the right hand along the left rein, and take the position or stand to horse.

To Dismount on the Off Side

301. 1. *To the right.* 2. PREPARE TO DISMOUNT. 3. DISMOUNT.

The second and third commands are executed as in par. 300, but by inverse means, the trooper coming to the ground on the off side.

To Mount from the Off Side

302. The trooper being dismounted and on the off side of his horse. 1. PREPARE TO MOUNT. 2. MOUNT.

The commands are executed as in par. 293, but by inverse means.

The Aids in Horsemanship

311. The training of the new horse involves the infliction of more or less pain, the necessity for which becomes less as his intelligence is quickened into understanding the lightest pressure.

A horse is *bit-wise* when (the bit being correctly fitted and properly adjusted, par. 284) he obeys the lightest pressure upon either bar.

He is *rein-wise* when he obeys the lightest pressure of the rein on either side of the neck, the bit not being disturbed from its normal position.

He is *leg-wise* when he obeys the lightest correctly combined action of the rider's legs.

The most thoughtful care should be constantly exercised in the combined applications of the aids, that they may not be opposed to each other in their action, *i.e.*, one favoring the intended move, the other opposing it.

Preparatory to the movements, the instructor mounts the squad and explains the uses of the reins and legs.

The reins and legs, the application of which determines the movements and gaits of the horse, are called the *aids*.

The trooper should not only know when to apply a given aid, but he should also understand why he applies it.

The reins serve to prepare the horse to move, and to guide, support, and halt him; their action should be gradual and in harmony with that of the legs.

In using them the arms should have free action at the shoulder; when a light pressure will be sufficient to govern the horse, the action of the hand should be at the wrist; for greater pressure, the elbow should be carried back, *but without raising the hand*.

In riding, the bridle hand should be kept steady and ought not to move with the body; it should merely oscillate with the motion of the horse's head; at the same time it must be kept light, for the bit causes pain if pressed constantly on the mouth, destroys its sensibility, and makes the horse's mouth hard.

The hand is light when there is an almost imperceptible alternate feeling and easing of the hand in harmony with the motion of the horse, by which the delicacy of the mouth is preserved, and the horse made to carry himself light.

That hand is best which, by giving and taking properly and keeping constant touch of the bit, controls the horse with the least force, and will best preserve the mouth.

As a rule, it is recommended that recruits ride with one rein in each hand; this will prevent the bad habit of holding the left shoulder advanced.

The legs serve to assist, together with the reins, in controlling the horse.

Closing the knees, without pressure by the lower part of the leg, tends to steady the horse in position. Carrying the lower legs slightly to the rear, closing them equally with slight pressure, prepares him to move, or, if moving, to keep him up to the hand. Closed with greater pressure behind the girth, they urge him forward.

Carrying the right (or left) leg to the rear, closing it with pressure, causes the horse to move his haunches to the left (or right).

The pressure of the legs must be an elastic muscular action, suited to the sensitiveness of the horse; a heavy, clinging pressure or dull thumping with the heels must not be permitted.

The reins act to direct the forehand; the lower legs incite to action and govern the movement of the haunches.

All changes of gait are made gradually. The horse should never be spurred to make a sudden start, nor should the reins be jerked.

To Trot

332. Being at the walk: 1. *Trot* (or *Slow trot*). 2. MARCH.

At the command *trot,* gather the horse.

At the command *march,* yield the hands a little and close the legs by degrees until the horse obeys, then the hands are gradually replaced and the legs relaxed.

The gait is slow at first, and the instructor sees that the troopers feel lightly their horses' mouth *without bearing upon the reins,* and explains that the necessary ease and stability are acquired by sitting well down on the horse, or saddle, and partially relaxing the body, thighs and legs, the hands oscillating with the motion of the horse's head.

He requires the troopers to preserve their seats by balancing the body; that they avoid the common fault of leaning the body too far or curving the back to the rear; that they sit erect and keep the thighs close to the horse.

To Pass from the Trot to the Walk

333. Being at the trot: 1. *Walk,* 2. MARCH.

At the command *walk,* gather the horse.

At the command *march,* rein in by degrees, and hold the legs close to prevent the horse from coming to the halt; as soon as he walks, replace the hands gradually and relax the legs.

To Mount (with saddle)

344. The horses equipped with saddles and curb bridles are habitually formed in line. The troopers standing to the horse, the instructor causes them to count fours, and commands: 1. PREPARE TO MOUNT. 2. MOUNT.

At the first command the odd numbers lead out.

All the troopers drop the right rein, take two back steps, stepping off with the left foot, at the same time sliding the right hand along the left rein; half face to the right; this should place the trooper about opposite

the girth; with the aid of the left hand take both reins in the right, forefinger between the reins, and place the right hand on the pommel, the reins coming into the hand on the side of the forefinger, and held so as to feel lightly on the horse's mouth, the bight falling on the off side. (TWO.) Place a third of the left foot in the stirrup, with the assistance of the left hand if necessary, and support it against the forearm of the horse; rest upon the ball of the right foot, grasp a lock of the mane with the left hand, the lock coming out between the thumb and forefinger.

At the command *mount*, spring from the right foot, holding firmly to the mane and keeping the right hand on the pommel; pass the right leg, knee bent, over the croup of the horse without touching him; sit down in the saddle; let go the mane, insert the right foot in the stirrup, pass the reins into the left hand and adjust them.

At the command: 3. *Form*, 4. RANK, the even numbers move up in their intervals.

Position of the Trooper (with saddle)

345. Same as previously explained (par. 294), with the following exceptions: Buttocks bearing equally and as flat as possible upon the middle of the saddle; reins coming into the left hand on the side of the little finger, and leaving it between thumb and forefinger; little finger between the reins, right rein above it; the other fingers closed, thumb pointing to the right front in prolongation of the forearm and pressing the reins firmly on second joint of forefinger; the end of the reins falling to the front and outside of the right rein; left forearm horizontal and close to the body without pressure; the back of the hand nearly vertical; right hand behind the thigh, arm hanging naturally; feet inserted in the stirrups so that the ball of the foot rests on the tread of the stirrup, heel slightly lower than the tread.

Stirrups

346. The stirrups should support the feet and the weight of the legs only, and be of such length that when the legs are in proper position, the feet out of the stirrups, the treads will be on a level with the lower part of the inner ankle bone.

The length depends somewhat on the formation of the man; a man with a thick heavy thigh requires a shorter stirrup than a man with a thin, flat one. For long distances at the gallop and trot, a shorter stirrup is required than at the walk.

When riding, the stirrups take up, in a measure, the weight of the body in its descent to the saddle, by a yielding of the ankles to prevent shock. This action is an easy, quick stiffening of the muscles which distributes the downward motion between the feet, thighs, and seat.

If, after the trooper has been exercised a short time at the slow trot, he has a close seat, his leg in proper position, with his heel down, but does not easily keep his stirrup, then the stirrup requires shortening.

Stable Duty

995. A noncommissioned officer, designated *stable sergeant,* or *corporal,* is detailed in each detachment to take immediate general charge of the forage and stable. He is held responsible for the proper policing and sanitary condition of the stable, picket line, and ground pertaining to them. One or more men, called *stable police,* are detailed for the purpose of policing, removing manure, feeding, etc., under the direction of the stable sergeant.

Usually horses are groomed twice daily, at morning and at evening stables, under the supervision of the stable sergeant and a commissioned officer. Under special circumstances, it may be advisable to groom only once a day.

The stable police, after grooming their own horses at morning stables, clean out the stalls and police the stable, under the direction of the stable sergeant. The bedding is taken up, that which is much soiled being separated for the manure heap, and the remainder put on the litter racks or spread upon the ground to dry.

At or before evening stables, the stable is policed; the bedding is laid down and fresh straw spread on top of it; the bed must be soft and even, with the thickest part toward the manger; where horses eat their bedding, the old litter should be placed on top of the new straw.

Grooming

The grooming is always done at the picket line, except in stormy weather. Stable call is the first call or warning call for stables, and precedes assembly by such intervals as may be prescribed. The roll having been called, the detachment is marched to the horses or stable, and upon arrival there the first sergeant commands, *Commence grooming;* FALL OUT. The horses are then tied on the picket line, if not already there, and are groomed under the direction of the platoon leader. Each man habitually grooms his own horse, except that the horses of the sergeants, first class, may, at the discretion of the company commander, be groomed by the men of the platoon to which these horses are attached. Drivers and wagoners groom the animals assigned to them.

For the purpose of proper supervision in grooming, feeding, etc., the horses of the men not assigned to platoons and other supernumerary horses, will be attached to platoons.

At stables, each man examines his horse's feet. Horses requiring shoeing are reported to the noncommissioned officer in charge of the section, who notifies the stable sergeant.

Each horse should be groomed not less than 20 minutes, and as much longer as may be necessary. When the horses of any platoon are sufficiently groomed, the platoon leader reports that fact to the first sergeant. The platoon at the discretion of the detachment commander, may then lead in, and the horses will be led to their stalls and properly secured under the supervision of the platoon leader. Should the officer wish to inspect the horses of any platoon or of the whole detachment before they are led in,

he will notify the platoon leader or the first sergeant, who will then command: *Cease grooming;* STAND TO HEEL; each man stands one yard in rear of and facing his horse. When all the horses have been groomed and led in, and the grooming kits put away, the sergeant will form the detachment, march it to the company parade, and dismiss it.

If, when the horses are inspected, the officer finds any of them not properly groomed, he will direct that these horses be left at the picket line and groomed under the supervision of a noncommissioned officer detailed for that purpose.

To Groom

997. Take the currycomb in the right hand, fingers over back of comb; begin on the near side at the upper part of the neck, thence proceed to the chest, arms, shoulders, back, belly, flank, loins, and croup in the order named. Then go to the off side, taking the comb in the left hand, and proceed as before.

The currycomb is applied gently and is used only to loosen the scurf and matted hair; it is not used on the legs from the knees or hocks downward, except to carefully loosen dried mud.

Next, take the brush in the left hand and change the currycomb to the right; begin at the head and then the neck on the near side, and proceed in the same order as in currying, brushing also the parts not touched by the comb; on the off side, take the brush in the right hand, the currycomb in the left. The principal working of the brush should follow the direction of the hair, but in places difficult to clean, it may be necessary to brush against it, finishing by leaving the hair smooth. After every few strokes clean the brush from dust with the currycomb.

Having finished with the brush, rub or dust off the horse with the grooming cloth, wipe out the eyes, ears, and nostrils, and clean the dock. The skin under the flank and between the hind quarters must be soft, clean, and free from dust.

Currycombs, cards, or common combs must never be applied to the mane or tail; the brush, fingers, and cloth are freely used on both.

The wisp is used when the horse comes in wet from exercise, rubbing against the hair until dry, from his hind quarters up to his head. If very wet, very hot, or very cold, blanket the horse, groom and hand-rub the legs; then remove the blanket and groom the body.

Feeding

998. Guiding principles in feeding are: (1) Feed in small quantities and often: (2) Do not work the animal hard immediately after a full meal. In garrison and on the march, animals should be fed at reveille, at mid-day, and at night, ordinarily one-third of the grain ration being given each time. In garrison, the stable sergeant, assisted by members of the stable guard or police, may feed at first call for reveille. In the evening, grain should be fed after hay has been distributed, the stable swept out and the dust thoroughly settled.

The men are marched to the forage wagons or other grain depository where the noncommissioned officer in charge, with an allowance measure, issues to each in turn.

The platoon leaders then march their platoons back to the horses and command: FEED. Ordinarily one man of each platoon will remain near the horses until they have finished eating, to adjust feed bags. Each man may be required to feed and groom as soon as he has received his grain.

Very little hay, if any, is fed in the morning when hard work follows, but about one-third of the ration should be fed at noon, and the remainder at night. The dust must be well shaken out of the hay when it is put in the mangers.

In camp hay is fed at the picket line morning, noon, and evening; on the march, when the horses are grazed during the day, in the evening only.

The use of bran once or twice a week is important for stable horses. In spring or early summer they should be grazed.

Two and a half ounces of salt should be given each week, preferably lumps of rock salt, secured in or near the manger.

Grazing should be encouraged at every spare moment, both in camp and at halts on the march.

The daily allowance of oats, barley, or corn is 12 pounds to each horse and 9 pounds to each mule; that of hay, 14 pounds to each animal; the allowance of straw for bedding is 100 pounds a month to each animal.

Watering

1000. Horses must be watered quietly and without confusion; the manner in which this duty is performed is often a good test of the discipline of a mounted command.

Horses are to be led or ridden to and from water at a walk. At the drinking place, no horse should be hurried or have his head jerked up from the water.

In the field or on the march, the watering is from the most convenient running water; in garrison, it is usually from troughs, which should be cleaned each day. In warm weather, water drawn from a cold well or spring should stand long enough for the chill to pass off.

The horses are watered under the immediate direction of the sergeant, but, if they are liable to meet those of other commands at the watering place, a commissioned officer should supervise this duty.

Horses should be watered before feeding or not until two hours after feeding. Ordinarily, they should be watered twice a day; in hot weather, three times a day.

In very cold weather, once a day, about noon, is sufficient. A horse will rarely drink freely very early in the morning.

If a mounted command have to march a long distance without water, so that it will be necessary to encamp en route, the animals are fed, but denied water until just before starting, when they are permitted to drink freely. The command marches in the afternoon, and does not encamp

until it has accomplished at least half of the distance, and moves early the next morning to reach water.

Watering the horses on the march depends in a great measure upon the facilities to be had. If nothing is known as to the country over which the day's march is to be made, water call should be sounded shortly before leaving camp and every horse given an opportunity to drink. As many animals, however, will not drink at an early hour or until after exercising the horses should be watered again at the first opportunity. On severe marches, frequent watering is of great benefit.

The daily allowance of water for a horse at rest is about six gallons; when at work, from eight to twelve gallons; for a man, one gallon for all purposes. One gallon of fresh water weighs 8⅓ pounds, approximately one pint to one pound.

General Rules for Stable Management

1118. The following general rules are recommended:

The stable sergeant has immediate charge of the police and sanitary condition of the stable, picket line, etc., and is the custodian of the forage and stable property generally.

The stable is to be kept thoroughly policed, free from smells, and, except portions of stalls that horses can reach, should be well limewashed. There must be no accumulation of manure or foul litter inside, nor near the doors or windows without. The feed boxes are washed from time to time, and kept clean. The ground about the picket line is swept daily, and all dung, etc., carried to the manure heap.

Except at night, when the horses are bedded down, no manure or urine is to remain in the stalls; the stable police remove it as it accumulates.

If practicable, all woodwork within reach of the horses, and not protected with sheet iron or other metal, should be painted with thin coal tar to prevent it being gnawed. The same precaution may be followed with regard to troughs, picket posts, and picket line. It should be thoroughly dried before putting horses near it.

Smoking in stables, or in their immediate vicinity, is prohibited.

One or more lamps will be hung in each stable to burn during the night.

The horses are stalled according to their positions in the squads; their places at the picket line will be in accordance with the same rule.

Over each horse's stall is placed the name of the horse, under that of his rider.

Clay is the best for earthen floors. Gravel, or sandy earth, is not suitable.

The sloping of the floor of stalls from the manger to the heel post is injurious and uncomfortable for the animal, making him stand in an unnatural position, with the forelegs higher than the hind ones. When the earthen floors are level, the horse will paw a hollow for his forefeet unless he can elevate his hind quarters by backing out of the stall.

Whenever horses go out of the stable, the windows of their stalls are to be kept open, unless necessary to exclude rain or snow, or when cold drafts affect the animals in contiguous or opposite stalls.

Stable doors are never closed in the daytime, except to keep out wet, or to exclude cold winds that blow on the horses. If the doors be in a single piece, bars are put across the doorway; if divided into upper and lower halves, it will usually be sufficient to open the upper part. At night, the entrance to the stables should be secured in such manner as will prevent the escape of animals.

When circumstances permit, horses should be turned loose in the paddock during the daytime, or herded under charge of a guard. When neither is practicable, they should, except in very cold, windy weather, or in very hot weather where there is no shade, stand most of the day at the picket line, as they have better air and are less confined, while the stables become drier and more healthful.

In ordinary climates, cavalry stables must be kept as cool as possible. If the horses do not stand directly in the draft, the colder the stable the less will they suffer if called suddenly to take the field. For the same reason, horses should never be blanketed in the stable, except during very cold weather.

Treatment and Care of Horses

1119. Horses require gentle treatment. Docile but bold horses are apt to retaliate upon those who abuse them, while persistent kindness often reclaims vicious animals.

A horse must never be kicked or struck upon or near the head with the hand, reins, or any instrument whatever.

At least two hours' exercise daily is necessary to the health and good condition of horses; they should be marched a few miles when cold weather, muddy ground, etc., prevent drill.

Horses' legs will be hand-rubbed often, particularly after severe exercise, as this removes enlargements and relieves or prevents stiffness.

In mild weather the sheath will be washed occasionally with warm water and castile soap, and then greased; in cold weather, when necessary, the sheath should be greased.

Horsese used freely in snow and slush must not be placed in a warm stable with littered stalls.

CHAPTER II

PACK SADDLE AND PACKING

THE MEDICAL DEPARTMENT PACK OUTFIT

		Each.
No. 1. Pack frame, of metal	number..	1
No. 2. Stretches of spreaders for saddle pads, of corrugated metal	number..	2
No. 3. Saddle pads	do....	2

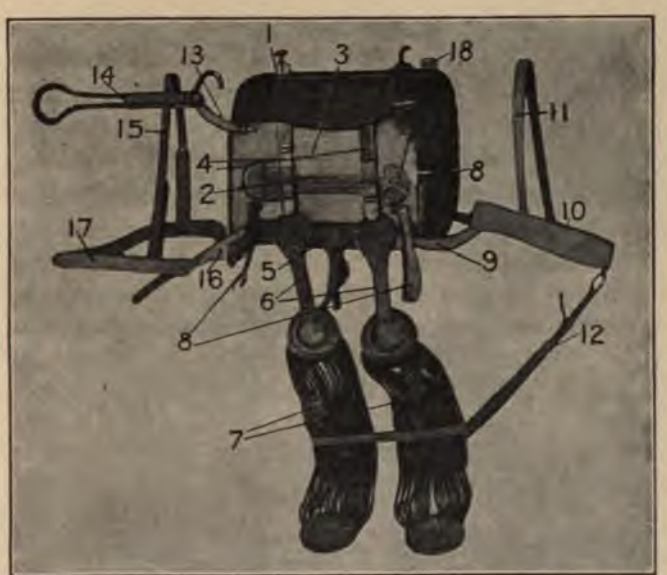

FIG. 250.—The Pack Saddle Proper.

No. 4. Quarter straps	do....	4
No. 5 and 6. Quarter strap ring sets, complete, consisting of 2 rings with leather union (5) and 2 cincha straps (6)	sets...	2
No. 7. Cincha, horsehair, double	do....	1
No. 8. Accessory leather straps	number..	6

		Each.
No. 9.	Breast collar straps.....number..	2
No. 10.	Breast collar body piece.....do....	1
No. 11.	Breast collar neck piece.....do....	1
No. 12.	Breast collar choke strap.....do....	1
No. 13.	Fork straps for turnback.....do....	2
No. 14.	Turnback and crupper, complete.....do....	1
No. 16.	Breeching hip strap.....do....	1
No. 16.	Breeching straps .....do....	2
No. 17.	Breeching body piece.....do....	1
No. 18.	Thongs, rawhide .....do....	6

ACCESSORY ARTICLES

No. 19.	Cargo slings, webbing, complete, with 4 straps..... number..	2
No. 20.	Load cincha (belly piece) short, complete, with 2 cincha straps .....number..	1
No. 21.	Cupped blind, complete, with 2 thongs.....do....	1
No. 22.	Load cincha (top piece) long, complete.....do....	1
No. 23.	Cargo cover, canvas, 3 by 6 feet, with 14 rawhide thongs.....number..	1
No. 24.	Mantas, canvas, 6 by 6 feet, with 20 rawhide thongs, number..	2
No. 25.	Bags, canvas, complete.....do....	2
No. 26.	Saddle blanket .....do....	1

METHOD OF USING THE PACK OUTFIT

As the pack outfits are issued from the supply depot, the pack saddle proper is assembled as shown in Fig. 250. The accessory articles are loosely packed in the shipping box.

To use the pack outfit, the pack saddle proper is placed on the animal with a saddle blanket under it. The breast collar and breeching are adjusted to the animal as required. The saddle is then firmly cinched in position. To prevent undesirable moving about on the part of the pack animal while the saddle and load are being placed in position, it is advisable to blindfold the animal by means of the cupped blind.

To load the animal, the webbing slings are placed on the ground with the link piece down. On them are placed such articles as

may be desired. Chests, bedding rolls boxes, etc., are conveniently carried in the slings; dressings, or a number of small pieces that are likely to be lost, can be put into the canvas bags and then placed in the slings. If desired, all articles may be previously wrapped in the canvas mantas to protect them from the elements. The sling is then securely fastened about the load by means of the leather straps secured to its metal rings.

The load is divided in such a manner that each sling will carry approximately the same weight.

The next step is to place the load on the animal. To do this, the loaded slings are raised from the ground and supported on the

FIG. 251.—Accessory Articles.

metal posts of the pack frame by means of the iron links on the slings. If possible, both sides should be loaded at the same time to prevent the saddle from turning on the animal's back.

The load is now protected by means of the canvas cargo cover, which is thrown over it and fastened by a number of its thongs. Over this is thrown the long canvas load cincha. By means of the

short-load cincha and its straps (which pass under the belly of the animal) the load can be securely fastened so that it will not shift.

Any additional load, such as sacks of grain, etc., for which there is not room in the slings, as well as such necessary articles as mantas, canvas bags, etc., not in use, are carried on the animal's back between the two sling loads, the long-load cincha holding them in position when tightened.

CHAPTER III

DRIVING

THE wagons which the hospital corps man may have to drive and care for are the four-mule escort wagon, the six-mule army wagon, and the four-mule ambulance wagon.

The standard wagon is the four-mule escort wagon. The load should not exceed 3,000 pounds on goods roads; for average conditions, 2,500 pounds is considered a fair load.

For the six-mule army wagon the load should not exceed 4,000 pounds on good roads; for average conditions, 3,500 pounds.

Wagons should always be supplied with a spare pole, an axe, a bucket for watering the animals, a hammer, a monkey wrench, spare bolts, a candle lantern, and a box of axle grease.

The ambulance is a four-wheeled vehicle, ordinarily drawn by two animals in garrison and four in the field. It provides transportation for eight men sitting or four recumbent on litters, or four sitting and two recumbent. It is fitted with four removable seats, which, when not used as such, are hung, two against each side. The arrangements for supporting the upper tier of litters (upper berths) consist of two litter-supporting posts and four straps. The litter-supporting posts are two uprights, placed 73 inches apart. The one in front it stationary, being secured to the roof and floor; the one at the rear is hinged at the top, and when the upper berths are not to be used it is strapped to the roof. When the upper berths are to be used, it is unstrapped and swung into a vertical position, when its lower end is secured to the floor by a slot and bolt. Fastened to each of the litter-supporting posts, 27¾ inches from the floor, is a socket for the inside handles of the litter, and opposite each socket, attached to the side of the ambulance, is a strap to hold the outside handles. The floor is 7½ feet long and 4 feet wide.

The art of harnessing and driving can only be taught practically. Familiarity with the parts of the harness (Fig. 252) and the methods of harnessing and unharnessing should be imparted to the whole class, and one man should be detailed at a time as assistant

to the ambulance driver and stable man in order that he may learn practically how to care for the animals and harness and how to drive.

The following course of instruction is taken from the "Service Manual for Sanitary Troops."

FIG. 252.—Harness. 1, Crown; 2, check piece; 3, front; 4, 4, Winds; 5, nose band; 6, bit; 7, curb; 8, check; 9, throatlatch; 10, rein; 11, collar; 12, hame; 13, hame link; 14, hame strap; 15, pole strap; 16, martingale; 17, trace-tug; 18, trace; 19, saddle; 20, terret; 21, belly-band; 22, turn-back; 23, crupper; 24, breeching; 25, hip-strap; 26, trace bearer

THE AMBULANCE DETACHMENT — THE DRIVER

380. To each driver are assigned four mules, a wheel pair, and a lead pair. The mule on the left side is called the near mule and the other the off mule.

381. At the discretion of the company commander, the ambulance orderly may be placed in charge of one pair of mules in harnessing and unharnessing and in hitching and unhitching at drill, and in the field when his services are not required by the sick.

DISPOSITION OF HARNESS

382. *In garrison:* The harness is arranged on two or four pegs in the harness room. If two pegs only are avaiable, the wheel set is placed on one peg and the lead set on the other. When four pegs are avaiable, the near harness of each set is kept on the left side of the off harness.

In the field: The lead bars are placed under the end of the pole, and the harness is hung over the pole. Care should be taken to keep the harness off the ground. In bad weather it is advisable to put the harness inside the ambulance.

TO HARNESS

383. A pair of quiet mules, in a double stall, is assigned to each recruit, who should be supervised at first by a competent man. The instructor causes a pair to be harnessed, points out the names of the different parts of the harness and explains their uses; he then causes the harness to be taken off and replaced on its pegs.

The harness being on the pegs, the instructor causes the recruits to *stand to heel,* and commands:

1. BY DETAIL, 2. HARNESS

Collar on: At this command each driver puts on and buckles the collar of his off mule, then that of his near mule.

Traces and breeching: Each driver takes the hames, traces, and breeching from the peg, carries them on the right arm and, approaching the proper mule from the near side, gently places the harness upon the mule's back. The hames are put on the collar and the lower hame strap buckled. Then the saddle is buckled on the near side, and the straps which are attached to either side of the breeching are attached to the ring in the martingale by means of snaps.

Bridle: The off mule is bridled first, then the near mule. Unless instructions to the contrary are given, the halters are removed before bridling. The check rein is taken in the right hand, the crown in the left; the mule is approached from the near side. The check rein is slipped over his head and allowed to rest on his neck. The crownpiece is then taken with the right hand and the bit in the left; the crown piece is then brought in front and slightly below its proper position. The left thumb is inserted in the side of the mouth, above the tusk, the jaw pressed open and the bit inserted by raising the crown piece. The ears are then gently drawn under the crown piece, beginning with the left ear. The throatlatch is then secured.

Couple: Each driver backs his pair out of the stall, places them side by side facing the stable exit, and attaches the reins properly.

To harness without detail:

1. HARNESS

The mules are harnessed in the manner described above. T
successive step is taken without command as rapidly as

TO UNHARNESS

384. The command is given:

1. BY DETAIL, 2. UNHARNESS

Uncouple: Each driver stands in front of his mules, uncouples the reins, and fastens them by looping them on the near hame of the near harness and the off hame of the off harness, and tying them with a half hitch, and then leads the mules into the stall.

Unbridle: He then unbridles the near mule, hanging the bridle on the near hame, puts on the halter, and fastens the chain to the manger; the same is done with the off mule, hanging the bridle on the off hame of the off harness.

Traces and breeching off: The various parts of the harness mentioned in *traces and breeching* are unfastened in reverse order. The left hand is used to place the breeching, saddle, and hames on the right arm in removing the harness from the mule. The harness is placed on its proper peg.

Collar off: He removes the collar of the near mule, then that of the off mule, and hangs them up in the same order, first near collar, then off collar.

Harnessing and unharnessing in the field is executed as in garrison with such modifications as the disposition of the harness requires. The mules are ordinarily tied by the halters to the wheels of the ambulance while harnessing and unharnessing.

FITTING HARNESS

385. When the recruit has become familiar with the methods of harnessing and unharnessing he will be instructed in fitting harness, and the importance thereof will be thoroughly impressed on him.

The bridle is so adjusted that the bit touches, but does not draw up the corners of the mouth.

The collar when adjusted should freely admit the hand between the lower part and the throat of the animal, and the fingers between the sides and the neck. A short collar chokes an animal by pressing upon the windpipe; a narrow one pinches and rubs its neck, and a broad collar works about and galls the shoulders.

The breech strap should be adjusted so that it will bear quickly when the animal is required to check the momentum of the ambulance, but will not impede his movements while in draft. This

adjustment is most important. It can best be made by observing the animal in draft, and tightening the straps as much as can be done without impeding the free movements of the animal while in draft.

The hip straps should be of such length that the breech strap will bear just below the point of the buttocks. The lower the breech strap is adjusted, the less does it assist the animal in checking the momentum of the ambulance.

The loin strap should be so adjusted that the traces, when in draft, will be straight and without downward pull on the loops that support them.

The length of the wheel and lead traces must depend in a great measure upon the size of the animal and his stride. The rule for lead pairs is to allow but 1 yard from the heads of wheel pair to points of buttocks of leaders when in draft. The wheel traces should be so adjusted as to allow at least 14 inches between hind quarters and singletree when in draft. The traces should be adjusted so that the line of traction will be straight from the singletree to the collar. This rule will regulate, in a measure, the length of the loin straps, and the matching of animals.

TO LEAD OUT

386. To form pairs after harnessing the instructor indicates the place of formation, and whether the formation is to be in line or in column of pairs, and commands:

LEAD OUT BY PAIRS

387. The pairs are led out by the driver, and formed at the designated place.

TO POST THE TEAMS WITH THEIR AMBULANCES

388. The teams are marched to the park in columns of teams, and so directed as to approach the flank and rear of the ambulance. As the head of the column approaches the ambulances the instructor commands:

TEAMS, TO YOUR POSTS

Each team, as it comes opposite its ambulance, wheels from the column and proceeds to its ambulance; having passed the end of the pole the driver causes the wheel pair to back so that the pole

between the mules. The lead pair takes its position immediately in front of the wheel pair.

THE PARK

389. Ambulances are ordinarily arranged in park in order in line, the ambulances being arranged from right to left in order of their numbers. The interval between vehicles may be either the normal of 12.5 yards, or such interval as the commander may direct. The three escort wagons are parked on the left in the same formation as the ambulances, or in a second park, as may be prescribed.

The lead bars are used to support the pole by means of one singletree.

In garrison ambulances are kept in a shed.

390. The column of drivers is halted in front of the building, the sergeant, first class, gives the necessary directions for the formation of the park, and commands:

FORM PARK

The drivers fall out and run the ambulances out by hand and form them in park.

The ambulances having been formed in park, the drivers fall in and are marched to the stable or picket line, commanded by the sergeant, first class.

TO HITCH AND UNHITCH

391. The brake is firmly set before teams are hitched to an ambulance or wagon, and hitching is so conducted that the mules are kept under control; until teams are well broken, this may necessitate the assignment of the orderly, or of other drivers, to assist the driver of the team.

392. Well-broken teams are hitched as follows: After lead and wheel teams have been harnessed, the lead teams tied near their respective ambulances, and the wheel teams placed in position in front of the ambulances, the pole between the mules and each driver at the heads of his wheel team, the command is given:

1. DRIVERS, 2. HITCH

The pole straps are passed through the rings on the chains at the end of the pole and fastened to the rings on the hames; the driver passes behind the near mule and attaches the near trace of the off

mule and the traces of the near mule. Going in front of the team, he passes to the rear of the off mule and attaches the fourth trace. He then brings the lead team into position, hooks the lead bar to the end of the pole, attaches traces as described above, takes the reins, first of the lead team and then of the wheel team, and mounts to the right side of the seat. The orderly mounts the seat from the left side.

393. At the command:

1. DRIVERS, 2. UNHITCH

Each driver reverses the several steps used in hitching.

DRIVING

394. Never pole too tightly, especially when the pole is a heavy one, because if the pole chains are tight the weight of the pole will continually rest on the neck. On the other hand, if the poling up is too loose the constant swaying will be a source of irritation and danger to the team.

COUPLING REINS

395. The correct adjustment of the two short inside reins, called coupling reins, requires great care. They should be so fitted that an even pressure is brought to bear on both sides of the animals' mouths, and in such a way also that both animals shall go straight and pull evenly on the traces. For instance, if the near horse carries his head to the near side, the coupling rein on the off side should be taken up, when his head will be straightened.

Supposing we have two animals apparently well matched, but that the near one carries his head rather out to the front, and has a light mouth, while the off animal has a hard mouth and carries his head close to his chest. Now, to get this pair to pull equally on the traces we must have the near animal's rein considerably longer than those of the off animal. In this case we should begin by letting out the off side coupling rein and taking up the near side rein the same number of holes.

The reins will now be adjusted so as to permit the near horse to hold his head well in front of the other, while the collars are brought level.

The most general fault is coupling up both reins too tightly, which makes the animals carry their heads in towar
going straight, as they should do. To p

this habit, it is a good plan to change their positions occasionally, instead of always driving them on the same side of the pole.

It is a convenient plan to have more than one hole in the billets for buckling the reins on the bits, so that an animal can be pulled back or let out a hole or two on either side without altering the coupling rein.

HOLDING THE REINS

396. Place both reins in the left hand, the near rein over the forefinger and the off rein under the middle finger. Thus you have two fingers between the reins. The reason for this is that it gives much more scope for play of the wrist on the mouths than if you have only one finger between the reins. The thumb should point straight to the right and the forefinger be held well out, pointing to the right rear. This will keep the rein close up to the knuckle, and the pair may be easily moved across the road by turning the back or hand up or down; up for left turn, down for right turn.

397. Sit firmly but comfortably in your seat, body erect, without stiffness, and elbows close to side. Do not lean forward. Now take the whip in the right hand, at the place where it balances comfortably, and you are ready to start.

398. Bring the pair to attention by feeling their mouths gently, and speak to them. If they do not respond, touch them gently with the whip.

The moment they start drop the hand slightly; "jibbing" is often caused by neglect of this precaution.

399. The elbows should be held close to the sides, with the points almost touching the hips.

The wrist should be well bent, as by this means the driver is enabled to keep a perfectly steady bearing on the mouths without any jerking.

The forearms should be horizontal, and the fingers from 3 to 5 inches from the center of the body, with the knuckles to the front

The thumb should not be pressed down on the rein. The fingers that should grip the reins are the three lower ones.

400. Never hit an animal while the right hand is holding a rein, because if you try to cut him when you have the off rein in the right hand you must slack that rein off, and the pair is apt to dash to the left.

401. Do not get into the habit of "jabbing" the pair with the

bits, and do not flap the reins on their backs to start them or make them increase their pace.

Drive at a steady, even pace, as nothing tires a team so much as to constantly change the rate of speed.

When it is necessary to pull up in a hurry, the proper course to pursue is to catch hold of the reins with the finger and thumb of the right hand, just behind the left, and shorten them as much as necessary by pulling them through. This is safer and more business-like than elevating the hands, which disturbs the seat.

402. The driving gloves should be large and very comfortable. They should never be of a size to cramp the hand in the slighest.

403. The right hand is known as the whip hand. It is generally used only for holding the whip, for assisting the left hand, and for shortening the reins by pulling them through from behind the rein hand.

DRIVING FOUR-IN-HAND

404. The driving of four animals as they should be driven is an art that can only be learned by constant practice and study.

405. When driving, the body should be kept upright and square to the front, but all stiffness should be avoided. The driving seat should be about three or four inches higher at the back than in front, so that the driver can sit well back in a really comfortable position. The ankles and knees should be just touching each other, and the arms close to the sides. The forearm should be about horizontal, and the left hand, as in driving a pair, from four to five inches from the center of the body, the back of the hand being turned toward the front, but inclined a little toward the team. The wrist should be bent slightly toward the body, and on no account allowed to bend the other way. This is far the best position for feeling the mouths, as the wrist then acts like a spring, and an even pressure can be maintained.

The driver should on no account be helf standing, or merely leaning against the seat, with unbent knees, as, in the event of a wheeler falling or shying to the side, he will probably be jerked off the wagon.

THE REINS

406. The best way of holding the reins is to have the near lead over the left forefinger, the off lead between the forefinger middle finger, the near wheel between the same and un

lead. The reins must be gripped firmly by the three lower fingers of the left hand. The thumb should point to the right, and the forefinger be held well out. The near lead rein should pass over or close to the knuckle of the forefinger and not over the first or second joint.

ADJUSTING THE REINS

407. All four reins can be shortened, if much is required, by pulling them through from behind, but it is generally quicker and neater to hold the reins with right hand two or three inches in front of left (the little and third fingers over the off-side reins and the middle finger between the near-side reins), and then slide the left hand up to the right. This movement is generally required when going down hill.

WHEEL REINS

408. It is better to shorten these by pulling them through from behind. This is necessary when going down hill, especially when the wheelers are loosely poled up, so as to prevent the singletrees from hitting the leaders' hind legs.

LEAD REINS

409. In order to shorten these, take out both the leaders with the right hand (the third and little fingers over off, and first or middle finger over near side rein); they then can be passed back to the left hand the required length by letting them slip through the right hand the necessary amount. To lengthen them, simply pull them through from the front.

NEAR LEAD REIN

Either push through from the front, with the full of the right hand over the rein, or take it right out of left hand and replace it the proper length.

OFF LEAD REIN

Push it through from the front.

NEAR WHEEL REIN

This is the most difficult rein to keep in its right place and to shorten. It is constantly slipping when the wheelers pull. It appears to be the best plan to pull it through from behind.

OFF WHEEL REIN

Push it through from the front with the right hand.

CROSSING THE ROAD

410. *To the left:* Turn the left hand, knuckles upward, and pass it across the body from left to right; the team will incline to the left, the reins on that side being shorter.

To the right: Pass the left hand down toward the left hip, back of the hand to the front, with the knuckles of the forefinger downward, and that of the little finger uppermost. This shortens the right hand reins and causes the team to incline in that direction. The whip can be applied to the off wheeler in the first instance, or to the near one in the second, if they do not cross rapidly enough.

TURNING TO THE LEFT

411. With the right hand seize the near lead and wheel reins under the lower fingers; then either pull those reins up toward the center of the body, which will shorten them, or allow the left hand to go slightly to the front, which will slack off the right reins, or, better still, combine these motions.

TURNING TO THE RIGHT

412. Take hold of the off lead and wheel reins with the lower fingers of the right hand and treat them in the same way as in using the left reins.

TO STEADY THE TEAM

413. In order to steady the animals or to ease the left hand, the right may be placed in front of the other over all the four reins, the third and little fingers being over the off reins and the upper fingers over only one of the near reins.

THE WHIP

414. The handle should rest in the palm of the right hand and be kept firmly in its place by the action of the thumb pressing against the base of the forefinger; the lower fingers will then be left free to catch hold of the reins.

If, however, it [illegible] ugh from behind, the lower fin[illegible] to allow the thumb and

Hold the whip at an angle of about 30° to the left and about 40° upward.

The thong ought to have three or four turns round the handle.

The point of the thong should be just under the inside of the thumb; this will keep it from slipping. Hold the whip where it will balance comfortably, the end of handle under the forearm, the wrist well bent, and the elbow close to the side.

415. When the right hand is on the reins or using the whip, it should be kept close to the left, the forearm being nearly horizontal. It can then rest on the thigh and yet be ready for any emergency.

416. The wheelers should be hit in front of the saddles, to avoid making them kick. It is no use hitting the wheelers if the leaders' reins are too long. In this case you must first shorten up the wheelers' reins, and then use the whip on the leaders; otherwise, as soon as the wheelers have jumped into their collars, the leaders will again press forward and allow the wheelers to hang back as before.

417. The proper hitting of the leaders with the whip can only be acquired by constant practice when off the wagon. A good whip can hit his leaders wherever he desires and without the dangerous, flail-like swipes that some teamsters appear to consider necessary.

TO START

418. Feel all the animals' mouths, and, if necessary, give them the word to go, dropping the hand to them at once until the vehicle is fairly off. The wheelers ought to start the wagon, and this can be effected by touching them with the whip, if they require a hint. It is never safe to start without having the whip in the right hand, ready for immediate use. The whip is to the driver what the leg is to the rider, that is, it keeps the team up to their bits. As soon as the team is going straight, take the right hand off the reins, at the same time keeping it close by, ready for any emergency.

PULLING UP

419. When you want to pull up, shorten all the four reins by passing the left hand up to the right, or else by pulling all the four reins through from behind, as before explained; then, having the right forefinger on the near lead rein, the middle finger on the near wheel, and the lower fingers of the right hand on the off reins, pull both hands back toward the body, and if necessary lean back a little.

Should the team be getting the better of you, and you find that you can not stop it, it will be found a great assistance to place the right leg over all the four reins, as you may be able to stop them by the extra power and leverage by the position of th leg. Of course, it is understood the brake has been applied.

A FEW HINTS

420. Always keep a steady pressure on the reins.

Never move left hand from reins, even though the right may be holding them in front, as it is very difficult to get the left hand back into its place again with the reins in the right places.

Lead reins should seldom be removed from left hand.

Grip the reins tightly with the third and little fingers to prevent their slipping.

Alter position of the bits if the team pulls hard.

See to it that your wagon is always well greased.

Always take a pull at the team to steady it just before you arrive at the crest of a hill, and begin to descend slowly, holding the leaders steady, and with just enought traction to keep their singletrees from hitting them.

In crossing ruts and turning corners be careful that the leaders are out of draft; otherwise the pole may be snapped off or the wheelers pulled down.

If, while going down a hill, and especially when near the bottom, you find a wheeler slipping on his hocks, do not try to pull him up, but drop the hand and allow the team to go a trifle faster.

RULES OF THE ROAD

421. Always keep to the right when meeting vehicles.

On a narrow road a loaded team has the right of way, and it should be given ungrudgingly.

On overtaking a vehicle, pull out to the left and pass it at a steady pace and without cracking your whip or coming in too close.

When followed closely by another vehicle and both are at a good pace, signal with your whip if you are about to slacken your gait or change your direction.

When approaching a railroad crissing, bring your team to a walk; halt if necessary, but always look and listen.

Be courteous in observing the simple rules of the road; giv

of room to others, and do not forget that a smile or a pleasant laugh will do more for you than a growl or a surly remark. Horsemen, as a rule, possess good dispositions; meet them at least half-way.

CARE OF DRAFT ANIMALS IN THE FIELD

363. Constant and intelligent supervision of adjustment of the bearing parts of harness, packs, and saddles is productive of better results than medication in keeping transportation animals in serviceable condition.

364. In preparing for the field it is well to bear in mind that nearly all animals in a command lose flesh rapidly for the first ten days of a march, and that during this period the adjustment of all parts of the harness, more especially the collars, should be given close attention.

365. If the march should happen to be a continuous and a sever one, it may be noticed that about the sixteenth day draft animals appear suddenly to become very lean in the muscles of the shoulders, back, abdomen, and croup. If a fair amount of forage is avaiable they quickly improve to a certain point, where they remain stationary and continue to do hard work without noticeable change under an intelligent system of watering and feeding. They are now in working condition.

366. *Water* on the march whenever a good opportunity to do so presents itself, never forgetting, however, that a warm animal should be watered but sparingly, and that such a watered animal should not be allowed to remain stationary even for a few minutes, as this induces laminitis (founder), due to contraction of the internal blood vessels by the cold water taken and the consequent increase of blood pressure in the legs and feet where it can not, while the animal is inactive, be taken care of by the system. Laminitis (founder) is due to congestion of the feet.

367. *Feeding.*— Soon after reaching camp, offer a little hay. Water before feeding grain when possible. Offer grain immediately after watering, and then place before the animals what remains of the hay for that day. The morning watering must of necessity be governed by circumstances. If absolutely sure of water on the road, say one hour after breaking camp, it would be a needless waste of time and energy to water immediately before or after the morning feed on the line.

368. *Midday baiting.*— As little as 1 pound of grain per animal,

taken from the daily allowance and given in charge to each driver, fed at the noon halt, will have a wonderful effect for good on the animals of a command. At this halt the careful driver will add a few handfuls of grass, and at the same time look over his collars and breeching with a view to their readjustment.

369. *Collars* of steel are preferable to leather for military use when properly adjusted and cleaned. When improperly adjusted they are inferior to the leather article. Steel collars are adjusted by means of bolts and plates. Leather collars by means of top straps and hames. When these methods will not produce the desired results the use of collar pads must be resorted to. Felt collar pads are not desirable, as they soon become stiff and hard.

A collar should fit snugly to the sides of the neck without compressing it, and its bearing surface should rest squarely on the bed of muscles situated on the front of the shoulder. When in position there should be a space between its lower part and the windpipe sufficiently large to comfortably admit the insertion of the open hand, back up, as far as the wrist.

All collars should be furnished with a neck plate of zinc for the protection of the top of the neck against rubbing.

To prevent blistering of the top of the neck on hot, sunny days it will be found that wet sponge or a wet piece of folded gunny sack, properly secured to the top of the collar and wetted at intervals, is effective.

The bearing surface of steel collars should not be scraped unless considered absolutely necessary to remove accumulated dirt due to negligence. If scraped they should be boned smooth and then slightly oiled. Leather collars may be easily cleaned with a damp sponge. They should be thus cleaned each evening. A careful man will not let his collars remain on the ground overnight, but will hang them on the pole, or put them in some safe place where he will protect them from the rain and the dust of the camp.

370. *Necks and shoulders.*— On arrival in camp let collars remain in position for about 15 minutes. Their weight on the hot, tender skin affords sufficient pressure to prevent the formation of swellings so often observed after the collar is suddenly removed. Normal, circulation will establish itself gradually under collar pressure alone and the skin of the shoulders and neck will regain its tone and elasticity.

After removal of the collar, bathe the shoulder and neck with clean water; this to remove sand and dust that would otherwise remain in the hair, where it may not be reached with the horse brush.

Salty water, or a weak solution of vinegar in water, when applied to the shoulders and neck, acts as a tonic to the jaded skin.

Animals with narrow, lean shoulders should not be placed in the collar. For these, if they must be harnessed, a breast strap (Dutch collar) should be used.

When putting on a collar, see that the mane hangs naturally beneath the neck plate. If the collar is a steel one, be careful when snapping it in place that the skin of the upper part of the neck is not pinched between the neck plate and the collar itself.

If swellings appear on the shoulders, use massage to remove them, and in addition apply a cold-water pack during the night; a wet sack properly adjusted and held in place will answer the purpose. If a gall appears, do not grease it. Wash it with water and soap, dry thoroughly, and apply a weak solution of alum (one-half ounce to a pint of water) or a solution of aloes in water (one-half ounce to the pint). If the animal must be worked, use a chambered (cut-out) pad over the spot to remove pressure. Greasy ointments serve as a trap for dust and sand.

371. *Traces.*— Verify the length of traces frequently. Do not depend on the chain links as a guide in hitching. Leather traces stretch considerably in wet weather. A difference of half an inch in the length of traces will cause trouble on the shoulder of the shorter side. It is also liable to produce lameness due to irritation of extensor muscles. If the point of attachment of the trace to the collar should be too high, it will cause a downward pull on top of neck, with its consequent irritation. If too low, it will cause the collar to "ride," and nearly all the pressure will be on the point of the shoulders and on the windpipe.

The number of sore-shouldered draft animals in a command on the march is an excellent standard by which to judge the horsemanship of the personnel.

372. *Breeching.*— The breeching should be fairly loose, otherwise it is liable to chafe the quarters and to interfere with the free play of the muscles. It should be taken up as the animals become thin.

Martingales should not fit too snugly, as they are very liable to chafe the soft, thin skin of the under part of the body.

373. *Yoke straps* should be adjusted with a view to the height of the pair. They should never be permitted to trespass on the bearing surface of the collars.

374. *Backstraps* should be so adjusted as not to let the saddles ride the withers, but at the same time there should not be sufficient strain on them to cause the crupper to irritate the under part of the tail.

375. *Bellybands and cinchas* should never be unduly tightened, as they cause cinch sores near the elbow and quarterstrap sores beneath the ring shields.

When a cinch gall appears, remove the cause, keep the place clean, and apply a solution of aloes or alum in water. Either of these will stimulate the gall and deter insects from alighting on the wound.

376. *Bearing reins* should be of such a length that the animals may have free use of the muscles of head and neck. Bearing reins are not a necessity.

377. A driving bit should be smooth and jointed. It should be so adjusted that it will not lift the corners of the mouth. If placed too high in the mouth, the animal uses his molar teeth to press against it, and gains for himself the reputation of a hard-mouthed puller.

378. Beware of thread ends in collar pads and of knots in headstalls, throatlatches, bellybands, cinchas, and surcingles, and be careful that buckles are not turned toward the skin. These readily produce irritations and abrasions, and are plain evidence of negligence and carelessness on the part of the rider or driver, as well as loose supervision on the part of those superior in rank.

379. To keep his animal in the collar and off the lead line should be the aim of each driver. This can be accomplished with little trouble, barring accidents, if the harness is kept in proper shape and fit and necks and shoulders are kept clean.

Wagons in the field should be inspected at the end of each day's march, and, if practicable, all necessary repairs made promptly. Particular attention should be given to discovering the loss of nuts and to replace the missing: a good supply of nuts and a few extra bolts should be carried in the tool box. The axles should be greased daily and care taken to remove the old before putting on fresh grease.

List of articles carried on each wagon:

	Number
Axe, front of wagon	1
Axle nuts, in tool box	2
Bucket G. I., under rear of wagon	1
Sponge, in tool box	1
Currycomb and brush, in tool box	1
Cases axle grease, in tool box	2
Extra hames, in tool box	2
Lantern, in water bucket	1
Wagon wrench, in tool box	1
Open links, in tool box	3
Pole, on side of wagon	1
Reach, on side of wagon	1
Pickax, on side of wagon	1
Three-eights or one-half inch rope, on side of wagon, ft	150
Spade, on side of wagon	1
Hame straps, in tool box	3
Hame strings, in tool box	3
Shoe for each foot of each animal, previously fitted, in tool box.	1
Horse-shoe nails, in tool box	
Singletrees, under wagon	2
Doubletree, under wagon	1
Ball strong twine for harness repairs	1

Harness: The harness should be examined daily, and any defect or weakness should be repaired at once. When removed from the animals at night, harness should be placed where it will dry and not be thrown upon the ground. The collars should be carefully wiped off and the dirt removed from the remainder as far as practicable. Harness should be thoroughly cleaned at least twice a month. For this purpose use a bucket, lukewarm water, sponge, harness soap, harness dressing, neat's-foot oil, and lampblack. For ordinary cleaning, the following should be observed: Provide a rack to hang the harness on. When no better arrangement is at hand, insert one end of the wagon pole between the spokes of one of the hind wheels, above the hub. Strap it to the axle and hang the harness on the pole. Dampen the sponge in water and pass it over the harness until the dirt has become soft. Rinse out the sponge as often as

necessary, renewing the water when it is dirty. Then rub the sponge on the harness soap until a good lather is obtained, and give the harness a good heavy coating of it, and rub it until all dirt is removed. Then work up a thick soap lather, coat the leather part of the harness with it, and allow it to dry without further rubbing. When dry, put on a light coat of harness dressing with a clean sponge, touch lightly, only enough to spread the dressing, and do not rub. When harness is dry and hard from neglect, after cleaning as above, take a pint of neat's-foot oil for each single set of harness, pour the oil into a pan and mix it with lampblack in proportion of one teaspoonful to each pint of oil. Stir this mixture until it has a glossy black appearance. In cold weather the oil should be warm. Apply with a small sponge, rubbing it well in. When thoroughly dry, apply harness dressing as previously described.

PART IX

ARMY REGULATIONS

ALL soldiers are required to be familiar with so much of Army Regulations and the Articles of War as is contained in the *Soldier's Handbook*.

The following course is for noncommissioned officers and candidates for these grades.

MEDICAL DEPARTMENT — THE HOSPITAL CORPS

1404. The members of the Hospital Corps will be enlisted for and permanently attached to the Medical Department. In time of war the corps will perform the necessary ambulance service under such officers of the Medical Department and assistants as may be detailed for that duty.

1405. Sergeants, first class, and sergeants are appointed by the Secretary of War on the recommendation of the Surgeon General, after having passed a satisfactory examination as hereinafter prescribed. Corporals, lance corporals, and privates, first class, upon recommendation of their detachment or organization commanders are appointed (1) by the Surgeon General, if serving with troops under the immediate supervision of the War Department; (2) by the department surgeon or by the division surgeon of a mobilized division, if serving with departmental or divisional troops. Acting cooks are appointed by the commanding officer of a company or detachment of the Hospital Corps in such numbers as are allotted to the company or detachment by the Surgeon General, or by the department or division surgeon, by authority of the Surgeon General.

Sergeants, first class, and sergeants are given warrants signed by the Surgeon General. Corporals are given warrants signed by the

officer who appoints them. Ordinarily a warrant issued to a noncommissioned officer of the Hospital Corps confers grade under all assignments; but a limited warrant may be issued conferring grade for service only with a field hospital company, ambulance company, or company of instruction designated therein. Upon relief from assignment to such companies a limited warrant ceases and determines, and the noncommissioned officer holding the same reverts to his previous grade in the Hospital Corps.

No person shall be designated for examination for appointment as sergeant, first class, except by written authority of the Surgeon General. The candidate must have served as a sergeant not less than twelve months or as a hospital steward of volunteers or have acted in that capacity during and since the war with Spain for more than six months. No person shall be designated for examination for appointment as sergeant except by written authority of the Surgeon General, if serving with troops under the immediate supervision of the War Department, or of the department surgeon, or the division surgeon of a mobilized division, if serving with departmental or divisional troops.

The examination of a candidate for appointment as sergeant, first class, or sergeant will be conducted by a board of medical officers at the station where the candidate is serving. If the proper number of medical officers to constitute the board is not available at the station of the candidate he will be sent to the nearest station where a board can be convened. When the examination is for a limited warrant, the commanding officer of the organization in which the candidate is to serve will constitute the board. In all cases the report of the board will be forwarded directly to the officer authorizing the examination.

The allowance of enlisted men of the Hospital Corps of each grade as fixed by regulations and orders will not be exceeded, except by special authority of the Secretary of War. The proportion of privates, first class, to privates will not exceed two to one.

1406. A sergeant first class stationed at a place where no post return is made will make such personal reports as the Surgeon General may direct.

1407. Sergeants first class, though liable to discharge, will not be reduced. Sergeants, corporals, lance corporals, and privates first class may be reduced by sentence of a court martial, by the Surgeon

General, by a department surgeon, or the division surgeon of a mobilized division.

1408. To test the capacity of privates of the Hospital Corps for the duties of noncommissioned officers, the Surgeon General and chief surgeons may appoint lance corporals, who will be obeyed and respected as corporals; but no detachment shall have more lance corporals at a time than enough to make the proportion of all noncommissioned officers present for duty one to four privates of the Hospital Corps. Lance corporals are on the same footing regarding reduction as croporals.

1409. The commander of a field army, or of a division or brigade acting independently, is charged with the full control of the transfer from the line, the enlistment, reenlistment, and discharge of members of the Hospital Corps of his command.

1410. Enlistments for the Hospital Corps will be made in the grade of private. Sergeants first class, sergeants, corporals, lance corporals, and privates first class may be reenlisted in their respective grades and their warrants and appointments continued in force, provided they reenlist on the day following that of discharge. Each enlistment and continuance will be noted on the warrant or appointment by the surgeon. Recruiting officers at general recruiting stations may accept applicants for enlistment or reenlistment in the Hospital Corps upon the authority of the Surgeon General and will be guided by his instructions in making the physical examination of such applicants. Applicants may be accepted with a vision of 20/70 in each eye, correctible to 20/40 with glasses, provided that no organic disease exists in either eye. After enlistments recruits will be forwarded to such stations as may have been designated for them by the Surgeon General.

1411. Enlisted men of the line, musicians excepted, may be transferred to the Hospital Corps as privates by the commander of a division, separate brigade, or department, on the application of the surgeon of the post or command, forwarded through military channels. The application will state the age, character, physical condition, and habits of the soldier, date of expiration of current enlistment, and whether made for an existing or prospective vacancy. If the soldier be over forty years of age his special qualifications for transfer will be stated.

1412. Married men will not be enlisted as privates in or trans-

ferred to the corps, and no sergeant who is married shall be re-enlisted without special authority.

1413. Members of the corps will not be required to perform any military duties other than those pertaining to their corps. They will be instructed in such drills, both foot and mounted, as are necessary for their efficiency. They will not be required to attend ceremonies, except when directed by the commanding officer, and will ordinarily be inspected and mustered at the hospital. The forms of inspection will be in accordance with the prescribed drill regulations for the Hospital Corps.

1414. To meet the requirements of epidemics or other emergencies and to fill vacancies, members of the Hospital Corps may be transferred by the department commander, the quota of each post, as prescribed by paragraphs 1439 and 1440, not being permanently exceeded. Such transfers will be reported to the Surgeon General.

1415. Accounts of pay and clothing of members of the Hospital Corps will be kept by the surgeon under whose immediate direction they are serving. All members casually at a post, camp, or other station, are under the immediate orders of the surgeon except prisoners, who will, however, be borne on the muster rolls, morning report, and returns of the hospital corps detachment. If discharged, their final statements will be prepared by the surgeon.

1416. At every permanent military post there will be at least one noncommissioned officer of the Hospital Corps, and an additional noncommissioned officer for every additional four privates of the Hospital Corps.

1417. At every permanent military post there will be at least four privates of the Hospital Corps, six privates when the strength of the garrison is 200, and two privates additional for every additional 100 of strength. They will be assigned to the respective duties connected with the hospital service by the surgeon of the post.

1418. The number of noncommissioned officers and privates of the Hospital Corps to be stationed at general hospitals, arsenals, engineer stations, and independent posts will be determined by the Surgeon General under the direction of the Secretary of War.

1419. Special instruction in the methods of rendering first aid to the sick and wounded will be given to all enlisted men of the Signal Corps and of the line of the Army by their company officers for at least twelve hours in each calendar year.

1420. All men of the hospital corps will be instructed under the supervision of the surgeon of the post in the duties of litter-bearers and the methods of rendering first aid to the sick and wounded, and in the various subjects pertaining to the sanitary soldier.

GARRISON AND FIELD SERVICE

1427. Ambulances are vehicles provided for the service of the medical department. They will be furnished and repaired by the Quartermaster Corps. They will be used only for the following purposes: The transportation of the sick and wounded and the absolutely necessary nurses or attendants on duty therewith; the recreation of convalescent patients; the instruction of the Hospital Corps in the duties of the ambulance service, and in the field in urgent cases, for the transportation of medical supplies. All persons are prohibited from using them, or requiring or permitting them to be used for any other purpose. Ambulances will always be subject to the call of the surgeon, in garrison, and of the medical officer on whom responsibility for the transportation of the sick devolves, in the field, whose duty it shall be to report to the commander of troops any violation of the above-mentioned provisions governing their use. When practicable, in garrison, they will be housed near the hospital.

1428. Ambulances complete will be issued and classed as follows:

1. For mobile army troops, to accompany troops in the field.

2. For post purposes exclusively, *e. g.*, for Coast Artillery stations, recruit depots, certain mobile army stations which would require ambulance service after withdrawal of mobile army troops therefrom, military prisons, supply depots, etc. Department commanders will see that such of these posts as require ambulance service are provided with ambulances which do not belong to the divisional or other sanitary train of the mobile army.

3. For general hospitals and for reserve supply.

Ambulances under class 1 will be furnished in numbers prescribed for war basis in Tables of Organization; under classes 2 and 3 the number of ambulances to be supplied will be determined by the War Department on recommendation of the department commander as regards class 2, and of the Surgeon General, as regards class 3.

1429. At each post one or more privates of the detachment Hos-

pital Corps will be designated by the surgeon as ambulance driver only for ambulances not belonging to organized ambulance companies. In addition to his other duties he will care for the ambulance, its equipment, and harness, and see that they are ready for immediate use; and in the field he will care for the animals also. In garrison, when it is necessary to use the ambulance for any transportation purposes, the commanding officer, on the application of the surgeon, will see that the requisite animals are provided by the quartermaster and placed at the disposal of the surgeon. At stations of organized ambulance companies, class 2 ambulances may be used for garrison ambulance service or the ambulance company may furnish the garrison ambulance service, at the discretion of the post commander.

1431½. Transportation assigned to mobile army troops for sanitary purposes is classed as follows:

1. The sanitary combat train. (A pack mule to carry equipment for the regimental aid station.) These pack mules are provided in time of peace and are assigned to the organizations indicated in the Tables of Organization. They will be placed at the disposition of the surgeon when needed for drill of the Hospital Corps in packing, and will habitually accompany the combat train of the organizations to which they are assigned, both in peace and war.

2. Ambulances of class 1, paragraph 1428. These are marked with the words "Sanitary Train ——— Division," and with the number of the ambulance company to which assigned. Ambulance companies operated in peace are equipped with their quota of ambulances, and the remaining ambulances of the divisional sanitary train are attached in time of peace to combatant organizations of the division by the department commander. Ambulances so attached are available for garrison service in peace when required, as well as ambulances of class 2, and will be cared for by ambulance drivers designated by the surgeon. When the division is assembled, these ambulances accompany the organizations to which attached, join the companies to which they are assigned, and complete the ambulance equipment of the sanitary companies not operated in time of peace.

3. Wagons pertaining to the divisional sanitary train. These will be marked with the words "Sanitary Train ——— Division" and the number of the company to which assigned. Companies belong-

ing to the sanitary train which are operated in peace are equipped with their quota of wagons. In addition, wagons of the divisional sanitary train are attached to combatant organizations, as prescribed in Tables of Organization, for the transportation of the camp infirmary. When the division is assembled these wagons accompany the organizations to which attached and join the sanitary companies to which assigned.

1433. Hospital Corps personnel is classified as follows:

1. That portion attached to combatant organizations.

2. That portion assigned to units of the divisional sanitary train and to administrative offices in the field.

3. That portion assigned to the service of the interior for service in war, which should include only the minimum of trained men.

All men of the Hospital Corps will be carried on muster rolls and returns of the Hospital Corps, under "Remarks," as attached to a definite combatant organization, or as belonging to a unit of class 2, or to class 3. Department commanders will determine, on recommendation of the department surgeon, the number of men at each post or station to be assigned to each class, within the limits prescribed in Tables of Organization, and the individual men will be assigned to their respective classes and those of class 1 attached to organizations of mobile troops by the post commander on recommendation of the surgeon. Descriptive lists of men of the Hospital Corps of classes 1 and 2 will be kept in duplicate at posts, and all other papers required when sanitary personnel accompanies troops to which attached, will be prepared in advance so far as practicable. Medical officers assigned to stations of mobile army troops, except those on duty with ambulance or field hospital companies, will be similarly attached to organizations by the post commander on recommendation of the surgeon. Combatant organizations will carry attached sanitary troops in red ink on their muster rolls and returns.

1434. On the march each medical officer will habitually be attended by a mounted private of the Hospital Corps. Riding horses authorized in Tables of Organization will not be permanently allowed and assigned in time of peace for Hospital Corps men attached to combatant organizations. When practicable, the Quartermaster Corps will furnish horses for members of the Hospital Corps on duty in the field who are authorized to be mounted.

1437. No person, except the proper medical officers or the officers,

noncommissioned officers, and privates of the ambulance service, or such persons as may be specially assigned by competent military authority to duty therewith, will be permitted to take or accompany sick or injured men to the rear, either on the march or elsewhere.

1438. When members of the hospital corps are detailed for service in the field during Indian wars, or when left with the sick or wounded under circumstances which justify the expectation that their rights under the Geneva Convention will not be recognized, commanding officers will issue to members of the Hospital Corps revolvers or other available firearms.

GENERAL HOSPITALS

1439. General hospitals will be under the exclusive control of the Surgeon General and will be governed by such regulations as the Secretary of War may prescribe. The senior medical officer on duty therein will command the same and will not be subject to the orders of local commanders other than those of territorial departments to whom specific delegation of authority may have been made. The commanding officer of a territorial department may order to any general hospital located within the limits of his department and to the General Hospital at Fort Bayard, N. Mex., any cases of sickness and injury among officers and enlisted men under his command that are appropriate for treatment at such hospital. Officers and enlisted men on the active list of the Army who shall have been transferred to a general hospital for treatment only will, when fit for duty, be returned to their proper posts or commands by the commanding officer of the hospital, unless he shall have been otherwise instructed.

1440. Hospital transports, boats, and railway trains, after being properly assigned as such, will be exclusively under the control of the Medical Department, and will not be diverted from their special purposes by orders of local or department commanders or officers of other staff corps.

SERVICE OF HOSPITALS

1447. The senior surgeon is charged with the management and is responsible for the condition of the hospital, which will be at all times subject to inspection by the commanding officer. The senior

surgeon of the post will inspect the hospital every morning, and on Saturday will also inspect the detachment of the hospital corps.

1450. Patients will, if possible, leave their arms and accouterments with their companies.

1451. Whenever a soldier is detached from his company or other organization or station for treatment or observation by and under control of officers of the Medical Department, his company or other immediate commander will send the soldier's descriptive list direct to the medical officer in charge of the hospital or other place to which the soldier is or has been sent. If the list is not received by such medical officer in due time, he will make a direct call upon the proper officer to furnish the list. If no change occurs in the soldier's military status or accounts while he is under control of the Medical Department, his original descriptive list will be transmitted to the several officers under whose charge he comes in the course of subsequent transfers, should such ensue, from hospital to hospital, by hospital ships, hospital trains, or otherwise, or when he is sent to an organization or station for duty. In case the soldier is returned or sent to, or receives a furlough at the expiration of which he is to return to or join, a particular company or other organization or station, the list will be sent directly to the immediate commander of such company or other organization or station. When an original descriptive list is transmitted as hereinbefore directed, it will be transmitted within, and by successive indorsements upon, a wrapper whereon each responsible officer will state expressly that there has been no change in the soldier's military status or accounts since he came under the charge of that officer, will specify the period covered by that statement, and will state what disposition was made of the soldier. Each officer so transmitting a descriptive list will retain a proper record of his action.

If, however, changes occur in a soldier's military status or accounts while he is detached from his company or other organization or station and is under the control of the Medical Department, the responsible medical officer will at once open a new descriptive list from the data shown on the old descriptive list received from the officer last previously responsible in the case, and will make such additional entries on the new list as the facts may require. For his own protection, the officer making the new list will retain and file, with the records of the place at which the new list is made,

the old list with its wrapper, if there is any, bearing the indorsements of officers previously responsible. If subsequent transfers of the same soldier are made before or when he passes out of the control of the Medical Department, the new list so opened will be closed by the proper entries thereon and filed with the records of the place at which it was made, and a duplicate of the list so filed will be transmitted from each responsible officer to another by wrapper indorsement, as hereinbefore prescribed, so long as no change in the list is required.

Whenever a soldier detached from his company or other organization or station and under control of the Medical Department passes out of that control, his descriptive list (new or old, as the case may require under the foregoing provisions of this paragraph) will be forwarded at once by the responsible officer as follows: (*a*) In case of discharge, death, retirement, capture, desertion, return to duty, or upon receiving a furlough at the expiration of which the soldier is to return to his company or other organization or station, or upon being dropped, to the soldier's company or other immediate commander; (*b*) in case of transfer to another company or other organization or station, the list (new or old, as the case requires) to the immediate commander of the company or other organization or station to which, and a copy of the list, including copies of any wrapper indorsements pertaining thereto, to the immediate commander of the company or other organization or station from which, the soldier is transferred; (*c*) in case of transfer to the Government Hospital for the Insane, to the Adjutant General of the Army.

In the cases of soldiers detached from their companies or other organizations or stations and under the control of the Medical Department action will be taken by the proper medical officers as follows: If a soldier is discovered to be a deserter from the Navy or Marine Corps, paragraph 133 will be complied with; if a soldier is discharged, final statements will be furnished him; if a soldier dies, paragraph 162 will be complied with.

1452. Sick or wounded soldiers, discharged while in hospital, will be entitled to medical treatment in hospital, and to the usual ration during disability, or for the period considered proper for them to remain under treatment, but a discharged soldier who has left the hospital will not be readmitted except upon the written order of the commanding officer.

1453. Recently discharged soldiers, needing hospital treatment, who arrive in New York City, San Francisco, or other port on Government transports, may be sent to one of the military hospitals in the vicinity, and rations in kind drawn for them while undergoing treatment.

1454. Tents, clothing, hospital furniture, and other stores used in the treatment of contagious diseases, will be disinfected or burned upon the recommendation and under the supervision of a medical officer.

1455. The Secretary of War may, on the recommendaiton of the Surgeon General, order gratuitous issues of clothing to soldiers who have had contagious diseases, and to hospital attendants who have nursed them, to replace articles destroyed by order of the proper medical officer to prevent contagion.

1457. Civilian employees at military posts, including employees of post exchanges, may be furnished the medical supplies prescribed for them by a medical officer under such regulations as the Surgeon-General may establish in accordance with law.

1458. A civilian employee on duty at a station where other than army medical attendance cannot be procured is entitled, when necessary, to admission to hospital.

1462. The surgeon of a post or command, or the commanding officer of a general hospital or other sanitary formation, will keep, account for, and expend the hospital fund, according to the instructions of the Surgeon General, exclusively for the benefit of the sick in hospital and of the enlisted men of the Hospital Corps and members of the Nurse Corps on duty therein.

HOSPITAL BUILDINGS

1466. When alterations of or additions to hospitals are necessary the surgeon of the post, after obtaining from the quartermaster an estimate of cost, will transmit plans and specifications, with proposed modifications, through military channels, to the Secretary of War. Similar action will be taken upon quarters for sergeants first class.

1468. Estimates for new construction, betterments, and repairs in connection with hospitals, Hospital Corps sergeants' quarters, and other buildings, structures, and systems payable from the appropriation for "Construction and repair of hospitals" or "Hospital stewards' quarters" will be prepared separately, but in the same

manner and forwarded at the same time as the estimates pertaining to other appropriations of the Quartermaster's Corps.

These estimates will be prepared by the quartermaster, to whom the surgeon will furnish in writing a statement showing the items required.

When the work has been completed the surgeon will report to the Surgeon General whether or not it was performed according to the estimate and will furnish to him a statement showing the material and balance of allotment remaining. Approved plans or estimates for construction or repair will be altered only by authority of the Secretary of War.

SICK CALL

1471. At sick call the enlisted men of each company who require medical attention will be conducted to the hospital or infirmary by a noncommissioned officer, who will give to the attending medical officer the company-sick-report book containing the names of the sick. The medical officer, after examination, will indicate in the book, opposite their names, the men who are to be admitted to hospital and those to be returned to quarters, what duties the latter can perform, with any other information in regard to the sick which he may have to communicate to the company commander. The senior medical officer of the command will make a daily report of the sick and wounded to the commanding officer.

MEDICAL ATTENDANCE

1473. Medical officers and contract surgeons on duty will attend officers, enlisted men, contract surgeons, contract dental surgeons, members of the Nurse Corps (female), prisoners of war and other persons in military custody or confinement, and applicants for enlistment while held under observation; also, when practicable, the families of officers and enlisted men; and at stations, or in the field, where other medical attendance can not be procured, civilian employees. Medicines will be dispensed to all persons entitled to medical attendance, and hospital stores to entlisted men and hospital matrons, also to officers at posts or stations where they cannot be procured by purchase.

1474. Medical officers and contract surgeons at their stations will furnish medical attendance to officers and enlisted men on the

retired list, but they will not be required to leave their stations for that purpose. Medicines, dressings, etc., will be supplied to retired officers and enlisted men from army dispensaries on medical officers' prescriptions.

MEDICAL SUPPLIES

1487. The routine issue of disinfectants is prohibited.

1488. Damaged or unserviceable medicines, medical books, surgical or scientific instruments and appliances, pertaining to the Medical Department, will not be presented to an inspector for condemnation until authority for so doing has been obtained from the department surgeon, or, if with a mobilized division, from the division surgeon.

ARTIFICIAL LIMBS

1490. Every officer, enlisted man, or employee of the military forces of the United States who, in the line of duty, or through disease contracted in service, shall have lost a limb, or the use of a limb, will receive once every three years an artificial limb or appliance, or commutation therefor, if he shall so elect, under such regulations as the Surgeon General of the army shall prescribe. The money value allowed as commutation is, for a leg, $75; for an arm, foot, and apparatus for resection, $50.

1491. Necessary transportation, including sleeping-car accommodations, required for travel to place where artificial limbs may be fitted, will be furnished by the Quartermaster's Department, the cost to be refunded from any money appropriated for the purchase of artificial limbs.

MANUAL FOR THE MEDICAL DEPARTMENT

PART I — GENERAL MEDICAL ADMINISTRATION

ARTICLE II — EDUCATION AND TRAINING

Field Hospitals and Ambulance Companies

157. A limited number of field hospitals and ambulance companies are maintained in time of peace to provide trained organizations for duty with the troops when they are on field service and to afford a means for training officers and men of the sanitary service in the work of the sanitary field organizations. So far as practicable men trained in these organizations should constitute that portion of the Hospital Corps personnel at posts which is assigned to units of the divisional sanitary train on mobilization. (See Army Regulations: *Hospital Corps.*)

In the training of these organizations special attention should be given to those elements of field work for instruction in which only limited facilities are afforded at posts, such as the practical use of the articles of field equipment, lines of aid, equitation, care of animals, and the use of the pack saddle.

158. The personnel of these organizations in time of peace comprise two classes: (1) A permanent cadre, consisting of such number of noncommissioned officers and men as are deemed necessary to maintain continuity of policy and method in instruction; (2) temporary personnel attached to these organizations for purposes of instruction.

(*a*) Details of organization of field hospitals and ambulance companies are given in Tables of Organization.

163. Records of class work will be kept for each individual in each subject of the course, preferably upon loose sheets appropriately ruled or in a blank book adapted to the purpose.

(*a*) The relative standings of men pursuing the same courses, as determined by their average monthly standings, will be published monthly to their respective classes.

164. Privates first class and privates who obtain a final mark of 70 per cent in each subject of the course, will be given certificates of proficiency on Form 60.

(*a*) Any man who, after two months' instruction, shows such

mental incapacity and inaptitude as to render his further attendance on this course of instruction useless, will be reported to the Surgeon General for his action.

(*b*) Men who fail to attain proficiency in any subject may, in the discretion of the officer in charge of instruction, be required to go over the subject again.

165. Enlisted men of the permanent personnel who shall have taken the prescribed course and obtained certificates of proficiency will not ordinarily be required to take the course again; but should it subsequently appear probable that any such enlisted man, having a certificate of proficiency, is nevertheless not proficient in one or more of the subjects, he may be required to take the course therein once more. If upon the second course the soldier does not show proficiency, his former certificate will be canceled by writing across its face the words: "Canceled for failure to qualify in ——— (naming the subject or subjects) on second course, ——— to ———, 19 ." This notation will be signed by the officer in charge of instruction. Failure to qualify on such second course will be reported at once to the Surgeon General with a view to securing the soldier's transfer to post duty, it being the aim of the department to retain in the permanent personnel only such qualified men as will be a constant example of efficiency to the men of the temporary personnel attached for instruction. Should, however, the soldier taking such second course in whole or in part be again found proficient a new certificate of proficiency will not be given him, but a notation of the facts will be made in his descriptive list. A third course will be required in no case. Lack of efficiency in practical work after a second course will indicate the necessity of other measures of discipline.

DISCIPLINE AND DUTIES OF THE SOLDIER

168. Instruction in discipline — including character, conduct, military bearing, obedience, and general efficiency — is to be taken up at once when the recruit joins the detachment, and never ceases, being given by commissioned and noncommissioned officers in connection with the soldier's daily round of duties and continued as long as he remains in the service.

169. Instruction in the duties of the soldier will cover the Articles of War, the soldier's handbook, the orders and regulations in regard to saluting, the granting of indulgences, arrest and confinement, the

wearing of uniforms, etc. Besides the few hours of formal teaching provided for in the first regular winter course in garrison every opportunity should be taken at all times to impart information in these various subjects.

BEARER DRILL AND FIELD WORK

170. Instruction in drill and field work will be given throughout the year for one hour a week. All members of the detachment will attend it unless excused by the surgeon for some special reason.

(*a*) This instruction includes all the subjects in Part I of the Drill Regulations and Service Manual for Sanitary Troops and all the usual employments of fieldwork, especially —

Uses of the first-aid packet.

Uses of other articles of the individual equipment of the Hospital Corps soldier.

First-aid treatment of fractures in all regions of the body.

The methods of transporting wounded in peace and in war.

Organization of the ambulance company. Work of the ambulance company during an action. Establishment of aid and dressing stations. Collection, care, and transportation of the wounded from the firing line to the field hospital, with the tagging of patients and the treating of them as indicated, using first-aid equipment and extemporized materials.

Use and care of articles of field hospital equipment.

Pitching and striking tentage and packing field equipment.

171. Full advantage should be taken of the summer marching and encampment of troops to impart the above instruction.

(*a*) Occasionally, throughout the year, all available men should be taken out for marches with and without the litter.

CARE OF ANIMALS AND EQUITATION

172. Men of the Hospital Corps will be instructed in the care of animals and in equitation as prescribed in Army Regulations and in General Orders.

WINTER COURSES OF INSTRUCTION IN GARRISON

173. The regular winter courses of instruction in garrison comprise a period of 34 weeks from November 1 to June 30. Acting cooks will be required to attend those in cooking only. All the other

men of the detachment will take the prescribed courses, except "qualified" men, men excused by the Surgeon General from further instruction under the provisions of paragraph 178*a*, and the absolutely necessary attendants in the hospital, such attendants being detailed as far as practicable from the "qualified" men and those excused by the Surgeon General. Night nurses, when on duty all night as such, will be considered "necessary attendants" within the meaning of this paragraph.

174. The winter courses are as follows:

Course No. 1.— For privates first class and privates. Subjects: Duties of the soldier, hours 8; anatomy and physiology, hours 16; first aid, hours 20; nursing, hours 36; total, hours 80.

Course No. 2.— For selected privates first class and privates. Subjects: Cooking and diet cooking, hours 12; materia medica and pharmacy, hours 24; elementary hygiene, hours 8; clerical work, hours 12; total, hours 56.

(*a*) The following textbooks will be used for study and reference: Mason's Handbook for the Hospital Corps; Drill Regulations and Service Manual for Sanitary Troops; Manual for the Medical Department; Army Regulations.

175. Practical performance of the work they are being instructed in should be required of soldiers pursuing the winter courses. While theoretical teaching by lectures, demonstrations, and recitations from textbooks has its place, it should be regarded as a secondary one.

176. The sequence of the subjects will be determined by the department surgeon, who will consider the climatic and other conditions in his department in arranging the year's instruction.

177. Each subject will be finished before taking up another, and upon its conclusion an oral examination therein will be held by the instructor, under the direction of the surgeon.

178. Records of class work in the winter courses will be kept in a blank book adapted to the purpose. Every soldier taking the courses will be marked in each subject thereof daily.

(*a*) Men who obtain a final mark of 70 per cent in any subject will be classed as "qualified" in that subject. Men who fail to obtain 70 per cent will be required to take the course the following year. If they again fail, their names will be reported to the Surgeon General, who may in his discretion excuse them from subsequent courses.

(*b*) Men who obtain a final mark of 70 per cent in each subject of one or more of the winter courses will be given certificates of proficiency therein on Form 60*a*.

179. Men who have previously qualified will be examined at the beginning of the winter courses to ascertain whether they continue qualified. If a soldier is found still proficient on such examination, that fact will be noted in his descriptive list and he will be excused from instruction in that subject; but a new certificate of proficiency will not be given to him. If, however, he is found deficient in any subject or subjects he will be required to take the ensuing course of garrison instruction therein.

180. The aggregate number of hours of instruction in bearer drill and field work, in care of animals and equitation, and in the regular garrison courses given during the period of a return of the Hospital Corps, Form 47, to each soldier carried thereon, will be noted in the appropriate column opposite his name on the return.

INSTRUCTION IN THE FIELD

181. In the field special attention should be given to field work, to include the care of animals, equitation, use of field appliances, camp sanitation, establishment of lines of aid in battle, etc. In the field no limit is to be placed on the amount of time to be devoted to this instruction.

ARTICLE IV — HOSPITALS AND MEDICAL ATTENDANCE

210. Patients will not be transferred from one ward to another without the authority of the commanding officer of the hospital. The transfer of a case from one ward to another will be reported to the office with the next ward morning report of the ward from which the case is transferred. All that is necessary is to report the patient's name, rank, company, and regiment or corps, and state the fact that he has gone from one ward to the other, designating them. No special form is provided. A memorandum will suffice, or a register card, Form 52, may be used. Upon the receipt at the office of the notice of transfer a memorandum thereof will be made on the back of the register card, which will thus always show what ward the patient is in.

211. To facilitate and assure the prompt and proper distribution

of patients, each ward surgeon will every morning, immediately after his morning round of the ward, forward to the office a morning report of the ward on Form 72, which will be accompanied by diagnosis slips for new admissions, by all change of diagnosis cards, by the clinical records of all cases completed in the ward or which depart from the ward otherwise than by transfer to another ward, and by the notices of cases transferred to other wards since the preceding report. The ward morning reports, being of no permanent value, may be destroyed after they have served their purpose.

EFFECTS OF PATIENTS

221. The commanding officer of the hospital is responsible that due care is observed in safeguarding the money, valuables, clothing, and other effects of patients admitted to hospital. Money or other valuables will be receipted for by the commanding officer or by an officer designated by him, and, when practicable, deposited in the hospital safe or in a bank. Enlisted men are forbidden to retain money or other valuables received from patients for safe-keeping.

(*a*) In the presence of the patient, or of another enlisted man in case the patient is unconscious or insane, his clothing and other effects will be tagged (Form 76) for identification and listed in duplicate on the patient's property card (Form 75). This list with the effects will then be sent to the individual in charge of the storeroom for patients' effects. He will retain the original list and turn the duplicate in to the record office, or give it to the patient as the regulations of the hospital may provide. In the smaller hospitals the duty of caring for patients' effects as outlined above will devolve upon the wardmaster; in general or other large hospitals it will be performed as directed in paragraph 303.

222. The soiled clothing of patients will be washed, before it is put away, as a part of the hospital laundry (par. 267). When there is reason to suspect that the clothing is infected such measures of disinfection as may be necessary to protect the command will be taken and accounts for the expenses incident thereto will be forwarded on Form 330, W. D., for settlement, with an explanation of the circumstances.

223. When the patient goes to duty, is furloughed, or is discharged from the service the surgeon will restore his effects and take his receipt.

224. When the patient is transferred from a hospital his effects will, if he is able to take care of them, be restored to him. When he is unable to take care of them, they will be intrusted to the ranking officer or soldier in whose charge the patient is put. A list of the effects will be furnished to such ranking officer or soldier, who will give his receipt therefor to the transferring officer. On arrival at destination said custodian of the effects in transit will turn them over, with the list, to the commanding officer of the receiving hospital, and take his receipt therefor.

225. In the event of the death or desertion of enlisted or commissioned patients or of military prisoners in hospital, their effects will be disposed of in accordance with the provisions of Army Regulations.

226. The effects of deceased civilian patients, if claimed within a reasonable time, will be delivered to their legal representatives. If not claimed within a reasonable time, they will be sold by the hospital council and the proceeds taken up and accounted for with the hospital fund. Should claim thereafter be made within three years for the proceeds, the same may on the authority of the Surgeon General be paid over to the legal representatives of the deceased. A similar procedure will be followed in the case of effects abandoned by civilian patients upon their departure from the hospital. Watches, trinkets, personal papers, and keepsakes of civilians will not be disposed of as long as there is a fair prospect of finding their rightful owners.

PUBLIC PROPERTY IN THE POSSESSION OF PATIENTS

227. Public property brought into the hospital by the patient will also be listed in duplicate on his property card, Form 75. If his disability is so slight as to require treatment for a few days only, the property will be kept intact, tagged, and restored to him upon his return to duty, taking his receipt therefor; otherwise, it will, if practicable, be turned over at once to his commanding officer, whose receipt should be obtained. If such transfer is not practicable, the following action will be had: (1) The medical officer will take up on his return the medical property in the soldier's possession and forward his receipt therefor to the accountable officer; (2) if the medical officer is accountable for quartermaster or ordnance property, he will take up on his quartermaster or ordnance papers all

property belonging to those departments brought in by the patient; otherwise he will transfer such property to the nearest representatives of those departments, whose receipts therefor should be obtained; (3) the patient's commanding officer will be immediately notified by mail of the action taken under (1) and (2). (See also pars. 640 and 649.)

228. Hospital clothing will be worn by patients only during their stay in hospital. Each article will be marked as hospital property. When very sick soldiers are transferred from one hospital to another the hospital clothing necessary for their comfort may be sent with them, properly invoiced, and accompanied by a check list, giving the names of the men in whose possession it is. Under the provisions of this paragraph, crutches and similar articles may, if necessary, be similarly transferred with the patient from one post or hospital to another. (See pars. 496 et seq.)

229. Upon the discharge from service of men permanently disabled, they may retain the surgical appliances then in their use which are necessary for their comfort and safety, and the accountable officer will drop the same from his next return of medical property, submitting a certificate explaining the circumstances as a voucher for so doing.

DESTRUCTION OF INFECTED PROPERTY

230. Infected clothing and other articles which can be immersed in boiling water, or otherwise disinfected, without material injury, should be disinfected and not burned. Articles destroyed to prevent contagion must be accounted for by the affidavit of the officer responsible, setting forth fully the circumstances necessitating such destruction. (See par. 502.)

MESS MANAGEMENT

231. The food supplies for the hospital personnel and patients consist of rations issued by the Quartermaster Corps, of articles purchased with or derived from the hospital fund (see pars. 248 to 262), and of products of the hospital garden.

235. Each ward surgeon will, every morning, immediately after the first round of his ward, fill out a diet card, Form 73, covering the diet requirements of his patients for the ensuing 24 hours. Bills of fare for regular, light, and liquid diets should be made out and

posted in the wards and kitchens. Additional articles not included in these diets are to be ordered for special cases only.

(*a*) The diet cards from the wards will be sent promptly to the hospital office, where the necessary card or cards will be made out covering the meals of the hospital personnel. All the cards will thereupon be turned over to the noncommissioned officer in charge of the mess in season for his action toward the preparation of the day's dinner. Additional cards for newly admitted patients or newly arrived personnel will be made out promptly when necessary and sent to the noncommissioned officer in charge of the mess without delay. The diet cards may be destroyed after they have served their purpose; usually they will have no value beyond the day of their date and the following day.

236. Each hospital mess will be placed under the immediate charge of a competent noncommissioned officer.

(*a*) It will be his duty to receive and care for all articles of food for the mess, and he will be held responsible for their proper disposition. He should be provided with suitable apparatus for preserving perishable foods and a suitable storeroom for the balance, and should secure them by proper locks. He will issue daily from the stores to the kitchen the articles required by the diet cards and will see that the food is cooked as indicated thereon. He will keep such record of his receipts and issues as the surgeon may prescribe according to the needs of the particular hospital, no special form therefor being provided. He will be responsible for the condition and cleanliness of the kitchen and cooking utensils, and the kitchen force will respect his orders accordingly. He will be responsible also for the cleanliness and discipline of the messroom, the service of the meals therein, and the distribution of food to wardmasters for patients unable to leave the wards; and for the cleanliness of the napery and table utensils used in serving the food. He will see that table clothing and utensils used for patients suffering from infectious disease are properly disinfected before being returned to the storerooms for further use. He will be provided with a sufficient number of assistants to assure the prompt and efficient performance of these duties.

237. A mess account on Form 74 will be kept by the noncommissioned officer in charge. It should be filed at the end of every month with the retained hospital fund papers for that month. In-

ordinate gains in the plus column would indicate undue economy in the diet, while, on the other hand, continual losses in the minus column would signify mismanagement of the hospital fund or improper care of the food supplies. The commanding officer of the hospital should inspect this record at frequent intervals, with a view to keeping constantly informed in this respect.

(*a*) When there is more than one mess, a consolidated mess account on the same form for the entire hospital should be kept in the office, the noncommissioned officers in charge of the several messes being required to report daily the data therefor.

238. For methods of preparing food for both sick and well, reference should be had to the authorized Handbook for the Hospital Corps and the Manual for Army Cooks.

DISPENSARY MANAGEMENT

240. All prescriptions will be written in the metric system. They will be placed on file in three separate files, as follows: (1) Prescriptions for alcohol or alcoholic liquors and for medicines containing opium or any of the salts, derivatives, or preparations of opium or coca leaves. (2) Prescriptions for civilians which do not include articles of the preceding class. (3) All other prescriptions. Prescription files will be subject to inspection by inspectors and post commanders at all times.

(*a*) In connection with file (1) a record will be kept of the dispensary receipts and expenditures of each article specified therein. Unless otherwise authorized by the Surgeon General, this record will be made on blanks of Form 17*a*, adapted as may be necessary to the purpose. A separate slip will be kept for each form in which the liquor or drug is supplied, as "Morphinæ sulphas, powder" or "Morphinæ sulphas, 10-mgm. hypo. tablets." The date of receipt thereof from the storeroom will be noted in the left-hand column and the amount, in the proper metric unit, in the debit column. The expenditures will be noted by entering the prescription number in the left-hand column and the amount expended in compounding the prescription in the credit column. At least once a month the slips will be balanced and the quantities remaining on hand will be verified by a medical officer and the facts noted over his signature.

241. Active poisons, alcohol, alcoholic liquors, and all habit-forming drugs will be kept under lock and key in a separate closet.

242. Civilian employees of the Army stationed at military posts may purchase medical supplies when prescribed by a medical officer.

(*a*) Medicine charges for employees not in hospital will be as follows: In ordinary cases, 25 cents for each prescription; in the case of rare and expensive medicines, dressings, appliances, etc., at such increased rate, to be determined by the surgeon, as will reimburse the United States their cost.

(*b*) Medicine charges for civilian employees in hospital are fixed at 25 cents a day in Army Regulations.

HOSPITAL FUND

248. The hospital fund is derived —

(1) From commutation of rations of patients and members of the Nurse Corps.

(2) From savings on rations of the Hospital Corps.

(3) From dividends from post exchange.

(4) From dividends from post garden.

(5) From money received for the subsistence of officers and civilians treated in hospital.

(6) From sales of property purchased with hospital fund (par. 259), or products pertaining to the hospital fund (vegetables from hospital garden, etc.).

249. In addition to the post exchange dividends due the hospital detachment, the exchange council, with the approval of the commanding officer, shall determine the amount, if any, to be turned over to the surgeon for the sick in hospital. (See Appendix: *Post Exchange Regulations.*)

251. The hospital fund is regarded as a company fund, and is applicable generally to similar purposes, in the interest of enlisted men of the Hospital Corps, and of the sick under treatment and members of the Nurse Corps on duty in military hospitals.

254. The officer commanding the hospital will see that due economy in expending the fund is observed, and that expenditures are not made for improper purposes. Receipts will be taken for all payments.

255. Gratuities to hospital cooks and assistant cooks may be authorized by department surgeons or the Surgeon General when the amount of the hospital fund on hand justifies such expenditure.

(*a*) A gratuity of not exceeding $10 a month may be paid from

the hospital fund to the hospital gardener, when authorized by the department surgeon or the Surgeon General.

(*b*) Vouchers for gratuities will cite upon their face the date and source of the authority for paying them.

ICE FOR HOSPITALS

263. The chief use of ice in hospitals is as an article of food or for the preservation of food. For such use it should be obtained from the Quartermaster Corps, from the ice plant, if one is available, as provided in existing orders (see Appendix: *Ice*), or as an issue under Army Regulations, when authorized; or by purchase from the hospital fund.

264. Ice required for medical administration proper, such as for ice baths of the sick, for medical photographic work, etc., should be procured from the Quartermaster Corps ice machine, if one is available, or be obtained by purchase at the cost of the medical and hospital appropriation. Routine purchases of ice for medical purposes will not be made without the previous authority of the Surgeon General, or, in the Philippine Department, of the department surgeon. Accounts for emergency purchases will invariably be accompanied by a separate statement of their necessity. Accounts for ice for medical work will be stated on Form 330 or Form 330*a*, W. D., will show in the officer's certificate (taking care not to encroach upon the approval space to the right of the $ sign) or on the blank fold on the back of the form, specifically what the ice was for — as, e. g., for use in the treatment of sick in hospital, for use in developing photographic negatives for identification work, etc. — and will be forwarded, with one invoice of articles purchased, Form 12, to the department surgeon, or if from a command under the immediate supervision of the War Department, to the Surgeon General, unless otherwise directed by him.

HOSPITAL MATRON

265. Authority for the employment of hospital matrons is given by section 1239, Revised Statutes. Their compensation of $10 a month and a ration in kind or by commutation is established by sections 1277 and 1295.

266. It is the duty of the hospital matron to mend and

repair the table, hand, and operating linen, the bedding and the hospital clothing belonging to the Medical Department, including the linen of the dentist's office, and to do the hospital laundry, or so much thereof as possible up to a minimum of 500 pieces a month, from time to time, as the same may be required by the surgeon.

(*a*) In the case of matrons on duty at the larger posts and at general hospitals the Surgeon General may modify or waive so much of this provision as requires the laundering of a minimum of 500 pieces of hospital linen a month in addition to all the mending.

267. The hospital laundry comprises: First, the linen, clothing, and bedding belonging to the Medical Department, as above enumerated; second, the washable clothing of patients admitted to hospital, which requires cleansing before it can be put away (par. 222); third, the white coats and trousers of the enlisted attendants (par. 47*a*); fourth, the uniforms (par. 93) of the Nurse Corps soiled while on public duty.

(*a*) Soiled blankets, spreads, and other heavy pieces should not be allowed to accumulate, but should be washed a few at a time as they become soiled, so as to equalize the matron's work.

268. The compensation of the matron being fixed by law, no extra compensation for performing any of the duties incident to her employment can be allowed, nor can other persons be employed at the expense of the United States to do her work or any part of it.

(*a*) Matrons are forbidden to farm out their work to other persons.

(*b*) Matrons are not entitled to leaves of absence or to pay and rations while absent or while unable to perform their duty.

(*c*) Matrons who are unable or unwilling to meet these requirements should be discharged.

269. When the number of pieces to be laundered is more than the matron can do (having in mind the minimum of 500 pieces a month above required) the excess may be put out under the provisions of paragraphs 270 to 278. When it would be an economy and advantage to put the entire laundry out instead of the excess only, the facts should be reported to the department surgeon for his information with a view to obtaining the necessary instructions and authority for further action. For the purpose of this report the matron's total compensation, including pay and allowances, is re-

garded as equivalent to $18 a month, of which $3 may be taken as for the mending, and the balance, $15, for the laundering.

LAUNDRY WORK NOT DONE BY MATRONS

270. The excess laundry at hospitals where there are matrons and the entire laundry at other hospitals (except those with laundry plants or otherwise provided for under special instructions from the Surgeon General) may be put out to private launderies. When competition is not had the responsible officer will ascertain the lowest prices current in the vicinity for good hand or machine work and govern his action accordingly.

271. Individual laundrymen and laundresses may be employed under this authority without advertising for proposals, provided they do the work in person, the same being regarded as personal services within the meaning of section 3709, Revised Statutes. The vouchers will bear a notation showing that the work was done by the creditor in person.

278. Vouchers for laundry at a hospital where there is no matron will contain in the officer's certificate the notation "No matron at post."

(*a*) Vouchers for excess laundry at a hospital where there is a matron will be accompanied by a statement showing the matron's name, the kind and number of pieces laundered by her and put to hire, respectively, during the period covered, and by a certificate that she was unable to do any of the laundry put out. These will be separate from the vouchers, which should contain no reference thereto.

GENERAL HOSPITALS

Officer of the Day

297. The officer of the day will be assigned to duty for a tour of 24 hours, during which he will always be accessible for cases of emergency and to meet the requirements of the duties hereinafter stated. He will be notified by the adjutant of his selection for duty on the day preceding that on which his tour begins. He may be required to perform his regular duties when they will not conflict with the performance of his duties as officer of the day.

298. Three noncommissioned officers will ordinarily be detailed permanently as assistants to the officer of the day, and there will be at all times one noncommissioned officer and one private on duty in his office. The noncommissioned officers will report to the officer of the day at the beginning of their respective tours of duty and will in no case leave the office until the arrival of their relief.

299. At an hour to be designated in hospital orders the old and the new officers of the day will report to the commanding officer, the old officer of the day to render his report, the new officer of the day to receive such instructions as the commanding officer may wish to give. At the expiration of his tour of duty the officer of the day will report in writing to the commanding officer the hours at which the prescribed inspections were made; any breaches of discipline, infraction of the hospital rules, neglects or disorders that may have occurred during his tour of duty; and any other occurrences which should properly be brought to the attention of the commanding officer.

300. The officer of the day will make a general inspection of the hospital at such hours as the commanding officer may direct. During this inspection he will note any disorder or neglect and, if practicable, will immediately correct the same. He will satisfy himself that the watchmen or guards are familiar with their duties and are performing them satisfactorily. During his tour of duty he will inspect at least one of the meals served in each hospital mess. He will receive the reports of the roll calls required by orders. On the outbreak of fire he will assume charge until the arrival of the fire marshal or of the senior officer present at the hospital. In the absence of the ward surgeon he will examine the body of any patient who may die during his tour of duty and order its removal to the morgue, notifying the adjutant of his action.

301. The officer of the day will examine and admit all incoming patients. If the officer of the day is temporarily unavailable, the noncommissioned officer on duty in the receiving office will notify the adjutant of the arrival of patients, and the adjutant will act in his stead or designate another officer to act temporarily as substitute for the officer of the day until he is again available. In no case will a patient be admitted and assigned to a ward until he has been seen and examined by the officer of the day or some regularly designated substitute.

(*a*) If there is any doubt as to the ward to which he should be assigned the patient will be held in the receiving ward for disposition by the chief of the medical service. The officer of the day will receive money and valuables from patients on admission and will turn them over to the registrar for safe keeping. An attendant from the receiving office will conduct incoming patients to the wards to which they have been assigned, care for their baggage and equipment, and turn over to the wardmaster the patient's admission slip. (See par. 209.)

302. The noncommissioned officers on duty with the officer of the day will keep a card index of patients in hospital and will enter gains and losses on the morning report of sick. (Form 71.)

303. Upon the admission of a patient to hospital the noncommissioned officer will secure his effects, other than money and valuables, list them in duplicate on the patient's property card (Form 75), tag them for identification (Form 76), and turn them over to the noncommissioned officer in charge of the store room for patients' effects. The latter will sign both lists, retain one of them and return the other, which will be filed in the registrar's office. Upon the departure of a patient from hospital the wardmaster will notify the noncommissioned officer on duty, who will obtain the list of the patient's effects from the registrar's office, and upon their delivery to the patient obtain his receipt, which will be returned to the registrar's office for file. (See par. 221.)

304. All public property left by patients at the hospital will be turned over to the quartermaster, who will dispose of it as indicated in paragraph 227.

305. In time of peace the noncommissioned officer on duty will have charge of the Hospital Corps men on duty as watchmen. He will satisfy himself that they have been properly instructed and understand their orders. He will maintain quiet and order in the hospital and will notify the officer of the day of any unusual occurrence.

306. In time of peace the hospital will be guarded by Hospital Corps men detailed as watchmen under the officer of the day and his noncommissioned assistants. In time of war the necessary guard will ordinarily be performed by a permanent detail of sanitary troops, and for this purpose the Hospital Corps personnel will be increased.

(*a*) When this detail from the sanitary troops is not available the necessary guard may be obtained on request from the department commander. When the commander of such a guard is a commissioned officer he will confer with the commanding officer of the hospital as to the character of the guard duty desired by the latter, but will exercise no control over the sanitary formation. If such a guard is not accompanied by a commissioned officer it will be reported by the noncommissioned officer in charge to the commanding officer of the hospital and will be placed under the immediate command of the officer of the day.

ARTICLE V — DEPARTMENT LABORATORIES

Water

357. The specimens should, when practicable, be collected by a medical officer. If the water to be examined is delivered through pipes or is pumped from a well or cistern, the local supply pipe and all pump connections should be emptied by allowing the water to run for 15 minutes before taking the samples.

358. *Bacteriological examinations.*— Samples of water for bacteriological examination should be collected in bottles furnished for the purpose. Each bottle is sterilized before leaving the laboratory, and the glass stopper is protected by a piece of heavy sterilized muslin securely wired to the neck of the bottle. The stopper should not be removed until immediately before the bottle is filled.

(*a*) In taking specimens from a faucet or pump (after emptying the supply pipes and connections conformably to par. 357) a small, gentle stream should be allowed to flow, the stopper taken out, the bottle grasped near the bottom, held in an upright position, and the stream permitted to flow into the bottle until it is filled to the shoulder. The stopper should then be replaced; both it and the cloth should be secured by carrying the wire several times around the neck of the bottle and twisting the ends tight. The stopper must be handled only by the square cloth-covered top. The lip of the bottle must not be brought in contact with the faucet or spout, nor should the neck of the bottle or naked part of the stopper be permitted to come in contact with any object during the manipulation.

The projecting flange is designed to protect the plug of the stopper, which it will do if the stopper, after withdrawal, is held by the top in a vertical position. The stopper should not be laid down and the cloth should not be handled by the fingers except in the act of securing the wire about it. When well water is to be examined the bottle should be filled directly from the bucket constantly in use for drawing the water, and from no other vessel.

(*b*) On account of the labor involved and the possibility of error, bacteriological examinations of water collected in any other than the prescribed receptacles will not be made.

(*c*) Each package should be plainly marked to show the source from which the sample is taken and the date of collection.

(*d*) The case should be marked, "Water for bacteriological examination," and it should be forwarded by mail at the earliest moment. (See par. 355*a*.)

359. *Chemical examinations.*— The quantity of water forwarded for chemical examination should be not less than 3 liters. The receptacles for transporting it should be chemically clean, and all vessels used in its collection should be as clean as it is possible to make them.

(*a*) Glass-stoppered bottles of suitable size are best adapted for the preservation of a sample of water in its original condition. In pouring the water into bottles it should not come into contact with the hands of the operator or with anything not essential to the operation. Bottles should be filled to within an inch of the stoppers; the stoppers should be carefully rinsed and inserted and secured with a canvas cover tied tightly around the neck of the bottle. Sealing wax or similar material should not be used to secure the stoppers.

(*b*) If no proper receptacles are available at the post or camp suitable bottles may be obtained upon application to the officer to whom the specimens are to be sent for analysis. Bottles so obtained should when filled be repacked in the box in which they came, reversing the cover, which should have the laboratory address thereon. The package should be tagged or labeled to show the place and date of collection.

(*c*) Water for chemical analysis should be shipped, immediately after its collection, by express. A Medical Department bill of lad-

ing will be made for each such shipment and the carrier's signature taken thereto upon turning over the package for transportation.

Until a special form shall have been provided therefor Form 153, Q. M. C., may be adapted to the purpose by altering the symbol "W. Q." in the upper right-hand corner to read "W. Medical," followed by the number of the bill. The consignor should in every case fill out the instructions for billing at the foot of the bill of lading, specifying therein that the freight charges are to be vouched to the Surgeon General, Washington, D. C., and should immediately mail the bill to the consignee, who will upon receipt of the articles accomplish the bill and surrender it to the carrier. The consignor should at the time of shipment furnish the carrier with a shipping order (Form 156, Q. M. C.), and mail a memorandum of the bill of lading (Form 154, Q. M. C.) to the Surgeon General, with information as to the purpose of the shipment unless the same is clearly revealed by entries on the bill.

ARTICLE VIII — RECORDS, REPORTS AND RETURNS — REGISTER AND REPORT OF SICK AND WOUNDED

The Register

427. A full record of the sick and wounded of every military post or station and separate command which is attended by a medical officer or private physician will be made on register cards, Form 52; but this requirement will not be applicable in time of war to troops or commands in the theater of operations, except camp hospitals (or field hospitals acting as such), evacuation hospitals, base hospitals and other immobile sanitary formations on the line of communications. (See pars. 575 to 582.) These cards collectively constitute the register of patients, and a case carded on them is said to be on the register.

(*a*) The commanding officer will provide the surgeon with any information the latter may not have which is necessary for preparing and completing the register.

428. A register card will be made:

(*a*) For every person admitted to the hospital for treatment.

(*b*) For every officer and enlisted man with the command, including retired officers and soldiers under assignment to active duty,

who, though not admitted to the hospital, is excused on account of sickness or injury from the performance of his military duty, or of some part of it, such as attendance on certain calls, drills, target practice, mounted duty, etc.

(*c*) For every officer and enlisted man with the command who, though not excused from duty, is prescribed for or treated, or placed under observation with a view to treatment or, in the case of an enlisted man, to discharge on account of disability, if his disability is of such a character as to have a probable bearing on his subsequent medical history: *Provided,* That a case once carded for record only under this provision will not again be carded for record only on the same register except when necessary to comply with the provisions of sections (*d*), (*e*), (*f*), and (*h*) of this paragraph. For example, every case of venereal disease or insanity, or suspected venereal disease or insanity, which comes under observation or treatment, will, unless previously on the register or otherwise required to be registered, be carded for record only under this provision.

(*d*) For every officer and enlisted man with the command, not currently on the register, who is retired or discharged for disability, or dies.

(*e*) For every officer and enlisted man with the command, not currently on the register, who is sent to another station or command for observation or treatment.

(*f*) For every officer with the command, not currently on the register, who departs from the command on sick leave.

(*g*) For every officer and enlisted man whose case is received by transfer conformably to the provisions of paragraphs 214 to 217.

(*h*) For every retired officer, retired soldier, former officer, or former soldier with the command but not in the hospital who dies.

429. Except as required by paragraph 428 a case prescribed for but not admitted to hospital or excused from duty will not be registered.

430. Cases under treatment by the dentist will be entered on the register of sick and wounded only when such entry is required by the provisions of paragraph 428.

431. When an officer or soldier sick in hospital is retired from active service, wholly retired from service, dismissed, or discharged, his case as an officer or soldier will be closed (par. 450) and a new

card made for it covering his continuance in hospital under his new status.

(*a*) If an applicant for enlistment sick in hospital is sworn in as a soldier, his case as a civilian will be closed and a new card made for his case as a soldier.

(*b*) Appropriate cross references from the old to the new cards, and *vice versa*, will be made in these cases.

432. The register cards will be made day by day as the cases are taken up. (See pars. 208*a* and 209.) They will be kept in two files, the current file and the permanent file.

(*a*) The current file will consist of the register cards of uncompleted cases arranged in dictionary order according to the surnames of the patients. It constitutes a ready index to all cases currently on the register. Cards will be transferred from the current file to the permanent file immediately upon their completion and the preparation of their report cards.

(*b*) The permanent file will comprise all the register cards of completed cases. The cards therein will be filed in the serial order of their register numbers.

(*c*) A card index to the register will be kept on Form 52*a*, one index card for each individual patient whose name appears in the register. When a register card is started and its number determined the index will be searched for previous admissions of the patient. If an index card for the patient is found, the new number will be entered thereon, and the number of the last previous admission will be noted on the new register card (par. 443). If no index card for the patient is found, one will be at once prepared. The index cards will be filed alphabetically in dictionary order according to the surnames of the patients.

433. Cases taken up on register cards should be borne thereon until finally disposed of. (See par. 450.)

434. The cards will be legibly written in indelible black ink, using the typewriter when practicable.

(*a*) Entries must not be crowded. When the space provided on the front of the card under any heading is not sufficient to complete an entry thereunder, the record thereof will be continued on the back of the card, or, if still more space is required, upon an extension slip. The extension slip must be of the same size as the card,

and be pasted to the lower margin of the back of the card, using about one-half an inch for the seam; this will place the seam at the top of the card when the latter is filed. When an entry is continued its two parts should be connected by cross references, using a small letter in parenthesis, thus, (*a*), so that the record can be readily followed.

435. The senior medical officer is responsible for the correctness and safe-keeping of the register. He will sign or initial all register cards completed during the period of his responsibility; but at general hospitals or brigade posts, or when specially authorized by the Surgeon General, he may designate one or more junior medical officers to sign or initial them, preferably in each case the officer in attendance thereon.

(*a*) When, in the absence of a medical officer, the command is attended by a civilian physician, he will sign the cards for the cases completed under his care.

436. Alterations and additions when necessary to correct or complete the record may be made in the register cards of uncompleted cases at the discretion of the senior medical officer of the command for the time being. A change of diagnosis will be indicated in the space "complication, seq., etc.," giving the date of the change, and the original entry under "cause of admission" will not be disturbed. A change of diagnosis in such cases requires no authentication, as its date places the responsibility for it. Other changes should be authenticated by the initials of the officer who makes them. (See par. 213.)

(*a*) Alterations and additions to the register cards of completed cases may be made in like manner by the medical officer who was responsible for the card at the time it was completed if he is still the senior medical officer of the command. If he has been superseded the card will not be changed, but a successor who concludes, upon information received, that the card is erroneous in any particular may file a supplemental card therewith of the same size as the register card, indicating thereon such conclusion and the information or reasons upon which it is based. The supplemental card should be headed "Supplemental card, No. ——," inserting the register number of the register card, and should be dated and signed by the officer filing it. A cross reference to the supplemental card identifying it by its date may appear upon the register card, but it will be

a reference only, thus, "See supplemental card dated ———," and contain none of the matter recorded on the supplement. (See pars. 462, 463, and 464.)

REPORT OF SICK AND WOUNDED

457. The report of sick and wounded comprises, (1) the report sheet (Form 51), which provides for general information and numerical tabulations concerning the command and the civilians therewith; (2) the nominal check list (Forms 51*a* and 51*b*) for a chronological list of cases registered; (3) the report cards (Form 52) for details of the several cases.

458. Subject to exceptions similar to those indicated in paragraph 427, this report is required monthly from every military post and separate command which is attended by a medical officer or civilian physician. It will be rendered separately for regular and volunteer troops, that of regulars to embrace all data pertaining to civilians. It will be forwarded before the fifth day of the next succeeding month as follows: From a general hospital or other independent post or command direct to the Surgeon General, unless otherwise ordered by him; from a transoceanic Army transport to the medical superintendent of the transport service at the transport's home port, for transmittal to the Surgeon General; and from any other organization or hospital to the department surgeon for like transmittal.

(*a*) When a hospital is closed or a command is discontinued a report covering the unreported period of service, giving the beginning and the end thereof, will in like manner be forwarded within five days thereafter.

(*b*) If there has been no case on sick report, either remaining from last report or admitted during the month, Form 51 will nevertheless be forwarded. It will give the name and strength of the command, etc., with such remarks as may be deemed of interest to the department surgeon or the Surgeon General.

459. All births and marriages occurring at the post or with the command and all deaths among the civilians with the command will be recorded on the report of sick and wounded under the heading "Births, marriages, and deaths."

460. A report card is required for every case registered during the month, and if the case is not completed until a subsequent month a

second report card will be forwarded with the report for the month during which it is completed. With the report for December, report cards will be forwarded also for all cases remaining December 31 which were registered previous to December.

(*a*) A duplicate of the report sheet and of the nominal list will be retained with the medical records of the post or command. At a permanent post the duplicate report sheets will be filed in and form a part of its medical history. (See par. 412.)

(*b*) The senior medical officer will fill in and sign the certificate at the foot of the first page of the report sheet. (See par. 400.) The report cards will be initialed as provided in paragraph 435 for register cards. If there is neither medical officer nor civilian physician with the command when the report is to be made, the officer in charge of the property of the hospital will make the report over his own signature and initial the cards.

(*c*) Alterations should in every instance be authenticated by the initials of the officer or physician who signs the report and initials the report cards respectively.

ARTICLE IX — SUPPLIES AND MATERIALS — GENERAL PROVISIONS

475. In preparing returns, requisitions, invoices, and receipts pertaining to medical and hospital supplies, the nomenclature, order of entry, classification, and weights and measures of the supply table will be followed. To facilitate the handling of these papers one line of writing only will be placed in each interlinear space. No letter of transmittal is required with them.

REQUISITIONS

Post Medical Supplies

477. Annual requisitions for post medical supplies will be prepared on Form 33, for the year commencing January 1, unless some other date is designated by the Surgeon General.

(*a*) They will be forwarded not less than 20 days before the beginning of the year, to the department surgeon, in quadruplicate,

or in the case of general hospitals and independent posts direct to the Surgeon General in triplicate.

478. Articles of which a definite allowance is given on the supply table will be required for on the annual requisition except as otherwise provided in paragraph 486. No remark will be made opposite the name of any article that a special kind or special make or pattern is wanted, as the annual requisition is intended to include only such articles as are kept on hand in supply depots for issue, and not such as have to be specially purchased; the latter when wanted must be asked for on special requisition.

(*a*) Only such quantities will be asked for as probably will be needed during the year, computed on the basis of original packages. Fractional parts of a bottle or package will not be asked for. The quantities asked for, plus the quantities on hand, must not exceed those specified in the table for the official population most nearly corresponding to that of the post or command. The quantity of each article on hand, as verified by a medical officer in accordance with paragraph 512*a*, will be stated and will be deducted from the quantity allowed annually by the supply table (ignoring for the purpose of this deduction fractional parts of bottles and packages on hand) to ascertain the balance which may be asked for, if needed.

(*b*) Before forwarding an annual requisition it will be carefully examined and compared with the supply table to see that it has been correctly made out in strict accordance with these regulations and to avoid the delay that its return for correction will occasion if they are not complied with.

479. The local prevalence or rarity of certain diseases, as well as the quantity or number on hand of each article, will be considered in the preparation and approval of annual requisitions.

480. The smaller posts will not need all the articles included in the supply table. The surgeon is not expected to require for an article merely because it is listed. He should call only for what there is reason to think he will need.

481. The department surgeon to whom an annual requisition is forwarded will see whether it is prepared in accordance with the above regulations. If it is, he will approve and forward one copy direct to the medical supply depot designated for his territory by the Surgeon General; if it is not, he will alter it to conform to these

regulations, and then forward it to the depot approved as altered. In either event, he will forward the second copy of the requisition, with the action taken by him noted thereon, direct to the Surgeon General. He will retain the third copy in the files of his office and will return the fourth copy to the surgeon with his modifications, if any, noted thereon.

482. Special requisitions for post medical supplies are annual, quarterly, or emergency. They will be made on Form 35, but separately from those for field medical supplies and those for dental supplies. The same number of copies will be executed, and they will be forwarded to the department surgeon or to the Surgeon General direct, as in the case of annual requisitions from the same posts or hospitals. (See par. 477*a*.)

483. Except as otherwise provided in paragraph 486, articles not on the supply table which will be needed during the year will be called for on the annual special requisition. It will be forwarded with the regular annual requisition. The articles will be listed in alphabetical order, and the necessity for them will be fully explained in the column of "Remarks." To avoid delay in filling these requisitions a full description of special articles, instruments, and appliances required for will be given in "Remarks," together with a statement of their cost or approximate cost, as ascertained from dealers' catalogues or other reliable sources of information. When unusual drugs or chemical reagents are called for similar information as to their cost will be furnished.

484. Except as otherwise provided in paragraph 486 and in the footnotes to the supply tables, articles on the supply table of which no allowance is stated, or which are issued "as required," will be called for on the quarterly special requisition.

FIELD MEDICAL SUPPLIES

489. Requisitions to replenish field medical supplies or to replace unserviceable field equipment at permanent posts will be executed in triplicate, on Form 35, and will be forwarded to the department surgeon, or, in the case of an independent post or station, direct to the Surgeon General.

(*a*) The department surgeon who receives a requisition in triplicate for field medical supplies in conformity with this regulatic

promptly forward the same, with his recommendations indorsed on each copy, to the Surgeon General. In the Philippine and Hawaiian Departments the department surgeons are authorized to act upon them as upon requisitions for post supplies. One copy of the requisition will be returned to the surgeon with modifications, if any, noted thereon.

490. Requisitions from permanent posts for field medical supplies should be unnecessary except immediately following active military operations or as the result of changes in the supply tables.

USE AND CARE OF MEDICAL PROPERTY

514. The stock of alcohol, alcoholic liquors, opium, and the salts, derivatives, and preparations of opium or coca leaves will be kept in a locked closed in the storeroom and only issued to the dispensary in unit containers from time to time as may be necessary, upon the written order of a medical officer.

(*a*) In the storeroom, receipts and expenditures of these articles will be accounted for in the manner prescribed for the dispensary (par. 240).

515. Field supplies and equipment will not be used as posts, except when required for purposes of instruction.

516. Field chests and appliances will be frequently inspected and kept in perfect order for immediate field use.

517. The exchange of medicines with druggists is prohibited.

518. The issue of articles for use in the preparation of cleaning mixtures, cosmetics, or perfumery, or for use with spirit lamps, etc., is prohibited.

519. The responsible officer will cause all instruments in his charge to be examined by a commissioned medical officer at least once each month.

520. Steel and plated instruments may be prevented from rusting by keeping them in a 20 per cent formalin solution saturated with borax.

523. Blankets not in use should be frequently examined and properly protected. When stained but otherwise in good condition they should be continued in service. Hospital bedding will not be used by members of the Hospital Corps, except when on duty in the wards.

524. When a typewriter is to be transported the ribbon spools

should be removed and packed separately, the carriage of the machine securely tied to the base in such a manner that it can not move in any direction, and the steel rods or blocks for locking the carriage placed in position. Medical officers will be held responsible for damages to typewriters which result from careless packing.

525. Rubber and flexible catheters and bougies will be kept in talc or glycerin to preserve them.

526. When the canvas in litters becomes soiled it will be removed from the litters, washed, and replaced. When it becomes torn or unserviceable new canvas of the proper size should be applied for to replace it.

Part II — The Sanitary Service in War

ARTICLE VIII—THE SANITARY SERVICES IN WAR—GENERAL CORRESPONDENCE, REPORTS, RETURNS AND RECORDS

Records of Sick and Wounded

567. During and after an engagement diagnosis tags will be attached to all wounded and dead as soon as practicable. They will be made out in duplicate.

568. In the case of wounded the primary purpose of the tag is to advise the medical officers under whose observation the wounded successively come of the treatment previously given at the several points of relief on the field or on the way to the rear.

569. The tag will be made out by the first medical officer or member of the Hospital Corps who treats the man previous to admission to a hospital on the line of communications. (It is unnecessary to tag a patient who is admitted to a hospital on the line of communications without having been previously tagged.) If the patient is badly hurt, the identification tag may be utilized to obtain the necessary information concerning his name, rank, etc. The original diagnosis tag will be attached to the patient's clothing.

570. The dead found on the field will be tagged in each case by the Medical Department troops who first reach the body, in order

that other medical personnel may not lose time examining it. The tag will be attached to the clothing of the deceased.

571. The duplicates of the diagnosis tags will be disposed of as follows:

(*a*) Those made out by the sanitary personnel of an organization for the officers and soldiers of their own command will be retained by the surgeon until disposed of as provided in paragraph 574.

(*b*) Those made out for officers and soldiers of other commands will be transmitted as soon as possible after the close of each day of an engagement to the division surgeon accompanied by the check list directed to be sent to that officer by paragraph 579.

572. The original tags will be disposed of as follows:

(*a*) Those of wounded who are returned from aid stations to the firing line without going farther to the rear will be removed and retained by the regimental surgeon.

(*b*) Those of wounded who are returned to their organizations direct from dressing stations (par. 682) or from the station for slightly wounded (par. 714*a*) will be removed upon their reporting for duty and be turned over to the surgeons of their several organizations, respectively.

(*c*) Those of wounded who are admitted to a field hospital and retained there for definitive treatment will be removed and forwarded to the division surgeon. If the patients are subsequently transferred to the line of communications, they will not be retagged, but will be accompanied by transfer lists in regular form (par. 583).

(*d*) Those of wounded who are being evacuated from the zone of the advance will not be disturbed until the patients are admitted to hospital on the line of communications, when the tags will be removed, stamped with the name of the admitting hospital, and the date of receipt of the patient, and forwarded immediately to the division surgeon of the division to which the wounded belong.

(*e*) Those of wounded who die while in transit from the field to hospital (the death in each case being noted on the tag as required by the printed instructions in the tag book), and the tags attached to the dead found on the field, will be removed when the bodies are prepared for interment or equivalent disposal, and will be sent likewise to the division surgeon.

573. The division surgeon will cause the tags received by him in

compliance with paragraphs 571 and 572 to be distributed without delay to the senior medical officers of the commands to which the men tagged belong, so that they may be available in accounting for officers or soldiers who would otherwise be carried as missing on the returns of their organizations.

574. Having served their purpose in completing the records of the organizations, all the tags, both originals and duplicates, will be forwarded with the next periodical lists of sick and wounded therefrom.

575. The register of patients prescribed by paragraph 427 and the monthly report of sick and wounded by paragraph 458 are not required from mobile troops or commands in the theater of operations. In lieu thereof a record or list of the sick and wounded with every mobile command in the theater of operations which is accompanied by a medical officer will be kept day by day by such officer on Form 53, as directed in the following paragraphs and in the instructions printed on the form. Field hospitals immobilized and acting as camp hospitals, evacuation hospitals, base hospitals, supply depots, contagious disease hospitals, field laboratories, and other similar sanitary formations will not be regarded as mobile units within the meaning of this paragraph, but will keep the register of patients and render monthly reports of sick and wounded in accordance with the regular rule.

576. The list of sick and wounded will contain a record of the following cases:

(*a*) Every officer or soldier with the command who is excused from duty on account of sickness or injury, or who receives a wound of any character in action whether it involves excuse from duty or not.

(*b*) Every officer or soldier with the command, not currently on the list, who is sent to another command or place for observation or treatment.

(*c*) Every officer, not currently on the list, who departs from the command on sick leave.

(*d*) Every officer or soldier with the command, not currently on the list, who is retired, or discharged for disability, or dies; and every civilian with the command who dies.

577. In determining the cases to be entered on the list of wounded under the provisions of paragraph 576, office

who are killed or wounded in action will be considered as with the command by whose sanitary personnel they are tagged. The names of such officers and soldiers will therefore not necessarily appear on the list of sick and wounded of their own organization. (See par. 579*a*.)

578. Except as provided in paragraph 580, the list of sick and wounded will be made in duplicate, and at the end of the month covered by it the original thereof will be forwarded through medical channels to the Surgeon General. The duplicate will be retained.

580. Stations for slightly wounded will make a single copy of the list of sick and wounded. At the end of each day and when the station is closed the list will be sent at once to the division surgeon.

581. Evacuation ambulance companies should include in their list of sick and wounded only such cases as pertain to their own personnel and such cases as may, under exceptional circumstances, fall into their hands without having been previously tagged by other sanitary formations.

582. Hospital trains and hospital ships make complete lists in regular monthly form only of cases occurring among their own personnel and, in the case of a hospital ship, of cases admitted thereto for definitive treatment.

583. Where patients are transferred from mobile organizations at the front to the line of communications a nominal list of them should if practicable be prepared in duplicate by the transferring officer, the original of which should be receipted and returned to him by the receiving officer. Extra carbon copies of so much as may be pertinent of the transferring officer's regular list on Form 53 may be made for this purpose. Transfers from camp hospitals in the zone of the advance, should there be any such, will be accomplished by regular transfer cards (par. 575).

(*a*) The duplicates of the nominal lists mentioned, or the transfer cards as the case may be, furnished as above to an evacuation ambulance company, will be turned over to the evacuation hospital or other sanitary formation to which it delivers the patients. Similar disposition will be made by a hospital train or hospital ship of the nominal lists or transfer cards received by it.

584. Should a hospital train or hospital ship receive patients unaccompanied by nominal lists or transfer cards, the commanding officer

of the train or ship will as soon as practicable prepare a nominal list of such patients on Form 53 (separate and apart from his regular monthly list of sick and wounded) for disposition as above provided. Should the preparation of such a list be impracticable he will list the patients who seem to be in danger of death so as to be able if death occurs to report the necessary details.

PART X

CLERICAL WORK

NOT all sanitary soldiers will make good clerks, but selected privates first class and privates who show special aptitude are required to take the course.

The nature, objects, and methods of preparation of the following reports and records are to be explained to the class and copies prepared and critized. Each member of the class should be required to prepare various reports. The list includes the usual reports and returns required of officers of the Medical Department in time of peace (for reports made under field-service conditions only, see par. 558, M. M. D.):

Name of report, etc.	Form No.	Number of copies	To whom sent.	Remarks.
(*a*) DAILY.				
(1) Surgeon's morning report of sick.	71, M. D.....	1	C. O.	Made after sick call. Returned by the adjutant to the hospital.
(2) Morning report, detachment of Hospital Corps.	332, A. G. O....	1	C. O.	Do.
(3) Daily sick report, detachment of Hospital Corps.	339, A. G. O....	1	Kept at hospital..	
(*b*) TRIMONTHLY.				
(1) Trimonthly report of enlistments.	18 A. G. O.....	2	1 to The A. G.; 1 retained.	At recruit depots and depot posts made by commanding officer. At other garrisoned posts and stations made by recruiting officer.
(*c*) MONTHLY.				
(1) Personal report of medical officer, dental surgeon, acting dental surgeon, or contract surgeon.	Letter	2 or 1	2 to S. G. through D. S. or 1 direct.	See pars. 12, 13, 18, 19, 32, and 55.
(2) Return of the Hospital Corps.	47*a*, M. D.....	2	1 to S. G. through D. S. or direct; 1 retained.	Monthly return for field use only. See par. 50.

Name of report, etc.	Form No.	Number of copies	To whom sent.	Remarks.
(c) MONTHLY—Con.				
(3) Efficiency report of nurses.	62, M. D.....	2	1 to D. S. or to S. G.; 1 retained.	See par. 99.
(4) Return of the Nurse Corps.	63, M. D.....	2	.... do	See par. 98.
(5) Pay rolls, enlisted men.	366, W. D.; 366a, W. D.	3	3 to C. O.....	1 returned to surgeon to be retained.
(6) Pay roll, Army Nurse Corps.	334, W. D.; 334a, W. D.	3	2 to paying Q. M.; 1 retained.	
(7) Ration return of matron and others rationed separately.	223, Q. M. C....	2	1 to C. O.; memo. kept at hospital.	
(8) Voucher for commutation of rations of enlisted men, Army Nurse Corps, etc., in hospital.	351, W. D.....	2	2 to C. O.....	1 original and 1 memorandum.
(9) Statement of hospital fund.	49, M. D.....	2	1 to D. S. or to S. G.; 1 retained.	See pars. 260, 261, and 262.
(10) Report of sick and wounded.	51 M. D.; 51a, M. D.; 51b, M. D.; 52, M. D.	2	1 to S. G. through D. S., or direct; 1 retained.	See pars. 457 to 464.
(11) Report of dental work.	57, M. D.....	2	1 to S. G. through medical channels; 1 retained.	See par. 473.
(12) Sanitary report	50, M. D.....	2	1 to The A. G. through military channels; 1 retained.	See pars. 414 to 417
(13) Report of medical examination of applicants for enlistment.	265, A. G. O....	2	1 to The A. G.; 1 retained.	
(14) Report of progress of repairs to hospital.	Letter	1	S. G.	See par. 245.
(15) Report of progress of repairs to quarters of sergeants first class, Hospital Corps.	.... do	1	S. G.	Do.
(16) Voucher for hospital laundry not done by hospital matron.	330 or 330a, W. D.	2	2 to D. S. or to the S. G.	1 original and 1 memorandum. See par. 277.
(17) Account current ...	320b or 320, W. D.	2	1 to S. G.; 1 retained.	Accompanied by the appropriate vouchers.
(18) Report of issues of medicine to civilians.	Letter	1	1 to S. G.; in Philippine Department to D. S.	See par. 244.
(19) Requisition for forage.	218, Q. M. C....	2	2 to C. O.....	
(20) Report of ordnance charges on muster and pay rolls.	94, O. D.....	2	1 to Q. M., who pays the detachment; 1 retained.	
(21) Statement of charges quartermaster property.	208, Q. M. C....	3	2 to Q. M.; 1 retained.	
(22) Report of meteorological observations.	Weather Bureau..	1	Through director State section Weather Bureau to S. G.	From designated posts. See par. 527.

Name of report, etc.	Form No.	Number of copies	To whom sent.	Remarks.
(*d*) BIMONTHLY.				
(1) Muster roll, detachment of Hospital Corps.	21, A. G. O.....	2	2 to mustering officer.	1 returned to hospital to be retained.
(2) Muster roll, soldiers in hospital.	.... do	2	.... do	Do.
(3) Return of the Hospital Corps.	47, M. D.....	2	1 to S. G. through D. S. or direct; 1 retained.	Bimonthly return in garrison. See par. 50.
(*e*) QUARTERLY.				
(1) Special requisition for medical supplies.	35, M. D.....	4 or 3	4 to D. S. or from independent posts, 3 to S. G.	1 returned to surgeon to be retained. See par. 482 et seq.
(2) Requisition for tableware and kitchen utensils.	166, Q. M. C....	3	2 to C. O.; 1 retained.	When Hospital Corps detachment is messed separately.
(3) Certificate of breakage, china and glassware.	207, Q. M. C....	2	Q. M.	When Quartermaster Corps china and glassware are used.
(*f*) SEMIANNUALLY.				
(1) Return of ordnance and ordnance stores.	18, O. D.; 18 cover.	2	1 to C. of O. (except in Philippine Department, where to D. O. O.); 1 retained.	Vouchers to accompany.
(2) Statement of charges for ordnance property on muster and pay rolls.	86, O. D.....	2	.... do	To accompany return.
(3) Return of horse equipments.	18a, O. D.....	2	.... do	Vouchers to accompany.
(4) Requisition for blanks	37 M. D.....	2	1 to S. G. (except in Philippine Department, where to D. S.); 1 retained.	
(*g*) ANNUALLY.				
(1) Statement of preferences.	423, A. G. O....	1	To The A. G. direct.	See instructions on the form.
(2) Efficiency report of officers.	429, A. G. O....	1	To The A. G. through military channels.	See Army Regulations.
(3) Requisitions for medical supplies.	33, M. D.; 35 M. D.	4 or 3	4 to D. S. or from independent posts, 3 to S. G.	1 returned to surgeon to be retained. See par. 477 et seq.
(4) Report of surgical operations.	58, M. D.....	1	1 to D. S. or to S. G.	See pars. 418, 419, and 420.
(5) Statement of repairs, etc., to hospital.	Letter	1	Q. M.	See Army Regulations.
(6) Statement of repairs, etc., to quarters of sergeants first class, Hospital Corps.	.... do	1	.... do	Do.
(*h*) OCCASIONALLY.				
(1) Ration return, detachment of Hospital Corps.	223, Q. M. C....	2	1 to C. O.; memo. copy kept at hospital.	Made at such intervals as the C. O. may direct.

Name of report, etc.	Form No.	Number of copies.	To whom sent.	Remarks.
(*h*) OCCASIONALLY—Con.				
(2) Report of change of station or status, M. O., D. S., A. D. S., C. S., H. C., or A. N. C.	Letter	2 or 1	2 to S. G. through D. S. or 1 direct.	See pars. 12, 13 18, 19, 32, 45 55, and 100.
(3) Change of station, M. O., D. S., or C. S.	.... do	1	To The A. G. direct.	See Army Regulations.
(4) Report of death of officer.	Telegram	1	To The A. G....	Of officers on active list who have no immediate commanders, and of officers on the retired list.
(5) Report of death of officer, enlisted man, or civilian.	Letter	1	C. O.	See par. 218.
(6) Report of death of M. O., D. S., A. D. S., C. S., or Sergt. f. c., H. C.	.... do	2	1 to D. S., 1 to S. G.	See par. 219.
(7) Certificate of death..	Local form	Usually 2	To local health officer.	
(8) Inventory of effects, deceased officer, enlisted man, or civilian.	34, A. G. O.....	3	2 to The A. G.; 1 retained.	See Army Regulations.: *Deceased Soldiers*
(9) Efficiency report of officers.	429, A. G. O....	1	To officer's new C. O. or to surgeon of his new station.	See Army Regulations.
(10) Efficiency report, Army Nurse Corps.	62, M. D.....	2	1 to C. O. of hospital to which transferred; 1 retained.	See par. 99.
(11) Efficiency report, Hospital Corps.	80, M. D.....	2	1 forwarded with D/L.; 1 retained.	See par. 46.
(12) Record of assignment and pay Army Nurse Corps.	66, M. D.....	2	1 to nurse's new C. O.; 1 retained.	See par. 76*b*.
(13) Enlistmen paper of soldier enlisting or reenlisting.	22, A. G. O.....	1	As prescribed on the form.	
(14) Report of physical examination of recruit.	135, A. G. O....	1	The A. G. direct.	
(15) Identification record, recruit.	260, A. G. O.; 261, A. G. O..	1	The A. G.; in the Philippine Department to the C. G. thereof.	
(16) Designation of beneficiary.	380, A. G. O....	1	The A. G. direct.	Notation made on soldier's D/L.
(17) Descriptive and assignment card, recruit.	25, A. G. O.....	1	C. O.	
(18) Account of clothing issued to recruit.	140, A. G. O....	1	To accompany descriptive and assignment card.	
(19) Descriptive list	29, A. G. O.....	.....	Number and disposition according to cricumstances as prescribed in regulations.	

Name of report, etc.	Form No.	Number of copies	To whom sent.	Remarks.
(*h*) OCCASIONALLY—Con.				
(20) Reservist's descriptive card.	443, A. G. O....	2	1 to reservist; 1 to office where records are kept.	See Appendix: *Army — Reserve.*
(21) Notification of transfer to Army reserve.	559, A. G. O....	2	1 to The A. G. direct; 1 retained.	Do.
(22) Allotment of pay...	38, Q. M. C.....	2	1 to Q. G.; 1 retained.	
(23) Discontinuance of allotment of pay.	39, Q. M. C.....	1	Q. G.	Notation of discontinuance made on retained copy of allotment of pay.
(24) Report of soldier's deposit.	Letter	1	C. O. with pay roll.	
(25) Advice of soldier's deposits.	8*a*, Q. M. C.....	1	Q. G.	
(26) Report of transfer, desertion, or death of soldier having deposits.	No form prescribed.	.....	Q. G.	In urgent cases report by telegraph.
(27) Final statement, enlisted man.	370, W. D.....	2	As prescribed on the form.	
(28) Notification of discharge, enlisted man.	3, A. G. O.....	1	Paying Q. M....	See Army Regulations: *Final payment, enlisted men.*
(29) Discharge certificate, enlisted man.	525, A. G. O.; 526, A. G. O.; 527, A. G. O.	1	Soldier	To be given by field officer of soldier's regiment or corps, or by the commanding officer when no field officer is present.
(30) Certificate of disability.	17, A. G. O.....	1	C. O.	
(31) Furlough	66, A. G. O.....	1	.... do	
(32) Statement of service.	15, A. G. O.....	1	To accompany charges against enlisted man for trial by court-martial.	
(33) Certificate of indebtedness of employee for hospital service.	490, M. D.....	3	As required by Army Regulations.	
(34) Special requisition for medical supplies.	35, M. D.....	4 or 3	4 to D. S. or 3 to the S. G.	1 returned to surgeon to be retained. See par. 485.
(35) Requisition for clothing (in bulk).	213, Q. M. C....	3	3 to Q. M. direct.	
(36) Requisition for clothing (individual).	165, Q. M. C....	2	2 to Q. M. direct.	Separate slips for each man drawing clothing.
(37) Statement of clothing.	165*b*, Q. M. C...	1	Retained	Filed with requisition to which it pertains.
(38) Requisition for ordnance.	386 O. D.....	3	2 to C. O.; 1 retained.	
(39) Return of medical property.	17, M. D.; 17*a*, M. D.; 17*b*, M. D.; 17*c*, M. D.	2	1 to S. G.; 1 retained.	See par. 507.

Name of report, etc.	Form No.	Number of copies	To whom sent.	Remarks.
(*h*) Occasionally—Con.				
(40) Report of survey...	196, A. G. O....	3	3 to C. O.....	See Army Regulations.
(41) Inventory and inspection report.	1, I. G. D.....	2	2 to inspecting officer.	
(42) Special sanitary report.	Letter	1	To The A. G. through military channels.	See par. 416.
(43) Report on officer or enlisted man who has been in general hospital three months.	Manuscript	2	2 to S. G.....	See par. 287.
(44) Report of appearance of epidemic disease at or near a military post or station.	Letter	3	1 to C. O.; 1 to D S.; 1 to S. G.	See par. 201.
(45) Report of appearance of epidemic disease in a military command en route to new station.	.... do	4	3 copies as in preceding case; additional copy to surgeon of new station.	Do.
(46) Notification to local board of health of appearance of infectious disease at a military post.	Letter or local form.	1	Board of health..	See par. 203.
(47) Reports of births...	V. S. 109.....	.....	To Director of Census.	See par. 401.
(48) Reports of deaths...	V. S. 98.....	.....	.... do	Do.
(49) Special reports of interesting cases.	Letter	1	S. G. through medical channels.	By the attending physician. See pars. 421 and 422.
(50) Report of change of combination of lock of hospital safe.	.... do	1	S. G.	See par. 247.
(*i*) On Breaking up of Hospital.				
(1) Current periodical reports and returns to be completed.	.....	.....	Number of copies and disposition as at the end of full stated periods in each case.	
(2) Retained records	.....	.....	The A. G. with schedule.	

LIST OF RECORDS

The following list includes all the principal records required to be kept in military hospitals in addition to retained copies of reports, returns, etc.:

(1) Register of sick and wounded (Form 52).
(2) Clinical records (Forms 55, *a* to *u*).
(3) Prescription files (par. 240).
(4) Register of dental patients (Form 79).

(5) Correspondence records (pars. 402 to 406).

(6) Record of instruction of the Hospital Corps (pars. 163 and 178).

CORRESPONDENCE RECORDS

The record card system, as prescribed in War Department orders, will be used for recording and filing the correspondence at the offices of department surgeons, unless otherwise directed by higher authority, and at general hospitals, medical supply depots, and such other offices as may be specially authorized to employ it.

The correspondence book system, as prescribed in War Department orders, will be used for recording and filing the correspondence of all post hospitals and other sanitary formations not mentioned in the preceding paragraph, except those for which some other system is specially prescribed.

All the usual reports and returns required of medical officers in time of peace are given in paragraph 398, M. M. D. Such of these as are applicable to the changed conditions will be made in time of war. The following special reports and forms are required only during campaign:

(*a*) *Daily field report of sanitary personnel and transportation* (Form 82).— This report will be made daily to the proper medical superior by the senior medical officer of every organization in the field, a copy being retained. Telegraphic report of the data called for thereon may be required if necessary.

(*b*) *Daily field report of patients* (Form 83).— This report will likewise be rendered daily, as in the preceding case.

(*c*) *Monthly reports from divisional sanitary inspectors* required by paragraph 747*a*, M. M. D., Form 50.

(*d*) *Reports of the sanitary inspections of Medical Department organizations* required by paragraph 748*a*, M. M. D., Form 50*b*.

(*e*) *Certificate of identity* (Form 61).— This certificate is issued to those who are entitled to wear a brassard but who do not wear a uniform. (See pars. 542 and 543, M. M. D.)

(*f*) *Diagnosis tags.*— On the battlefield diagnosis tags are applied to all sick, wounded, and dead and are used in recording and reporting casualties. (See pars. 567 to 574, M. M. D.)

(*g*) *List of sick and wounded* (Form 53).— With the exceptions noted in paragraph 575, M. M. D., this form will be used as a sub-

stitute for Forms 51, 51*a*, 51*b*, and 52 in reporting and recording the sick and wounded in the theater of operations.

(*h*) *Return of casualties* (Form 149, A. G. O.).— This report is made after every action in which casualties have occurred, by the commanding officer of each independent organization. Casualties pertaining to the personnel of the organization making the report only should be included. Regimental surgeons furnish regimental commanders with information necessary for the preparation of the report.

(*i*) In the case of Medical Department units which have quartermaster accountability such additional records, reports, returns, etc., as are required by the Quartermaster Corps must be kept and made.

The various blank forms for the preparation of the papers required by the several departments concerned are enumerated in paragraphs 961 to 965, M. M. D. They must be obtained as indicated therein for time of peace or, in the case of troops in the theater of operations, as prescribed in paragraph 551*b*, M. M. D.

Medical supply depots on the line of communications will make returns, reports, and records similar to those of home depots. In addition they will make to the surgeon, base group, the daily field reports of sanitary personnel and transportation required by paragraph 558, M. M. D.

PART XI

MINOR SURGERY

THE noncommissioned officer of the hospital corps must very frequently act as the surgeon's assistant, performing such duties as in civil life are assigned to a physician. He may have to take entire charge of the anesthetic, or act as the first, second, or other assistant. Indeed, the occasions are not infrequent when a small detachment is in the field without any medical officer, and the noncommissioned officer himself may have to do minor operations and permanently arrest hemorrhage.

CHAPTER I

ANESTHESIA, GENERAL AND LOCAL

AN anesthetic is an agent that abolishes sensation. It may be general or local. The former affects the whole system and produces unconsciousness and muscular relaxation. The latter affects only the part to which it is applied, destroying the sensation of the local nerves.

The principal *general anesthetics* are *ether, chloroform, ethyl chloride,* and *nitrous-oxide gas,* the latter being used almost exclusively by dentists.

Before commencing the administration of any anesthetic everything should be made ready; the patient should not have had any food, except perhaps a cup of coffee or bouillon, for five or six hours before commencing anesthesia. His head should rest on a low pillow covered with a towel, and the skin of the face, around the mouth and nose, which is liable to be irritated by the anesthetic, should be protected by vaseline.

On a small table to the right of the anesthetizer should be placed the appropriate articles, ether or chloroform, a screw gag, lever

gag, tongue forceps, swab-holder and swab, towel, teaspoon, sterile water, a hypodermic syringe charged with two milligrammes of strychnine, hypodermic tablets of morphine, digitalis, and strychnine, nitrite of amyl pearls, vaseline, and a basin for vomitus.

Pure sulphuric ether is generally considered the safest and best anesthetic for general purposes. It should be kept in tin cans in a cool, dark place. It is about two and a half times heavier than air and inflammable; therefore lights should not be brought near the inhaler, but gas jets four or more feet from the patient's head are safe. Throughout the anesthesia the body must be kept warmly covered.

Ether is now generally given by the drop method in the same manner as chloroform.

The arms of the patient must not be brought above his head nor allowed to hang over the edge of the table, as paralysis has followed the undue pressure in such cases; the forearms should be flexed and folded over the base of the chest, being rolled in the undershirt to confine them.

Assistants must be careful not to interfere with respiration by leaning on the chest.

Usually there is a stage of excitement marked by flushed face, increased heart action, some struggling, perhaps tremor and general rigidity of the body; all these symptoms are more marked in alcoholics.

The state of complete anesthesia is marked by relaxation so that the arm drops when lifted, snoring respiration, and the absence of winking when the eyeball is touched.

The anesthetizer must closely watch the pulse, respiration, and color of the patient, as well as his pupils and the conjunctival reflex. In complete anesthesia the pulse and respiration ratio should be about normal, the pupils should be contracted and should react to light.

Danger signals are marked — especially sudden — weakness and rapidity of the pulse, stopping of respiration, cyanosis, dilatation of the pupils, and absence of their reaction to light. The return of the conjunctival reflex — winking on touching the eyeball — indicates that the patient is "coming out" of the anesthetic.

Sudden cessation of respiration is often due to the falling back of the tongue over the opening of the larynx; in such a case the lower

jaw should be thrown forward by the fingers behind the angles of the jaw, and if this does not suffice the teeth must be forced apart, and the tongue drawn forward with tongue forceps (Figs. 253 and 254). If the respiration is not at once resumed artificial respiration must be resorted to.

Failure of the pulse is an indication for the use of stimulants and perhaps discontinuance of the ether.

Efforts at vomiting may usually be controlled by giving more ether, but if it can not be prevented the head should be turned on the side to allow the escape of the vomited matter.

FIG. 253.—Pushing Forward the Jaw for Treatment of Asphyxia.

Accumulation of mucus in the throat should be removed by a sponge on a sponge-holder.

Chloroform is given by the open or "drop method" so as to secure a free admixture of air; it is four times as heavy as air and not inflammable.

The *Esmarch inhaler* is supplied in the army, but a small handkerchief or a piece of lint folded once answers the purpose very well. In the absence of a chloroform bottle with dropping attachment, one can be extemporized by cutting a V-shaped trough on the opposite sides of the cork.

The same precautions must be observed as in ether anesthetic, remembering that while ether is a heart stimulant chloroform is a heart depressant and that the great danger with chloroform is heart failure.

A few drops of chloroform are placed on the inhaler, which is at first held some distance from the mouth and gradually approached, but never brought close enough to exclude the air. A few drops are added from time to time as the chloroform evaporates, but progressively less after anesthesia becomes complete.

The relative advantages of ether and chloroform may be summed up as follows: Ether is slower, requires much larger quantities, is less pleasant to take, causes much more irritation and costs more; it is usually safer.

In the field chloroform is preferable because of the much smaller

FIG. 254.—Drawing Out the Tongue for Treatment of Asphyxia.

quantity which it is required to transport and the shorter time necessary for anesthesia.

In the tropics ether, on account of its greater volatility, is hard to keep, and much more is required to produce anesthesia.

Local anesthesia is very useful in opening boils and abscesses, splitting inflammed piles, and in any operations of the fingers or toes.

There are two general classes of local anesthetics, those which destroy the sensibility of the nerves by freezing and those which must be injected hypodermically into the part.

Of the freezing agents the best is *ethyl chloride,* which is furnished in metallic tubes arranged so as to throw a fine spray upon the part; the tube should be held at a distance of ten or twelve inches, and when the part suddenly turns white sensation is destroyed. The objection to freezing agents is that the pain in freezing and thawing is almost as great as it would have been from the incision, and that sloughing may follow undue freezing.

The most generally useful local anesthetic is cocaine hydrochloride in solutions of two to ten per cent in water. In the mucous membranes the anesthesia is produced by the surface application, but in other tissues it must be used hypodermically. The anesthesia commences in a minute or two and lasts about fifteen minutes. If the cocaine is confined to the part so that the blood can not carry it away, as when a ligature is thrown around the base of a finger or toe, the effect may be maintained indefinitely.

The objection to cocaine is its depressing action on the heart and the danger of contracting the habit. The maximum quantity to be used subcutaneously is thirty to forty milligrammes. The solutions do not keep well and should always be freshly prepared and made with sterile water; the solutions themselves can not be sterilized by heat, as heat decomposes the cocaine.

Eucaine-B is sometimes used as a substitute for cocaine, in solutions of the same strength and in the same manner. It is slower in its action than cocaine, but not so depressing to the heart, its effects last longer, and its efficiency is not impaired by heat sterilization.

In *Schleich's method* very dilute solutions are used, but the tissues, especially the skin, are infiltrated with them. Schleich used three solutions of different strengths. The medium solution is prepared as follows:

℞ Cocain. hydrochlorid		100
Morphin. hydrochlorid		025
Sodii chlorid		200
Aq. destill	100	000

Sterilize solution and add gtt. ij. of five-per-cent phenol.

The stronger solution contains twice as much cocaine and the weaker one-tenth as much cocaine and one-fifth as much morphine.

To anesthetize the skin it is necessary to inject the solution *into* not *under* it.

In *spinal anesthesia* a solution of cocaine or eucaine is injected into the spinal canal between the fourth and fifth lumbar vertebræ, after withdrawing a small portion of spinal fluid; anesthesia without loss of consciousness is produced in all parts of the body below the seat of the injection.

The method has not met with general acceptance on account of its uncertainty, and because of the severe and even fatal accidents which have attended its use.

CHAPTER II

ASSISTING AT OPERATIONS

Minor Operations

In an operation the duty of the noncommissioned officer may be to prepare and hand instruments, to sponge, to assist in the operation, or to help in all three ways. He must watch the operation and operator closely and endeavor to anticipate the wants of the surgeon.

The sterilized instruments should all be laid out beforehand, as much as possible in the order in which they will be needed and those of the same kind grouped together. Needles should be placed in a shallow glass dish of alcohol and a few should always be threaded ready for use. In threading, the suture should be held in the right hand and the needle held in the left and passed over it; catgut or tendon may be cut obliquely and flattened between the handles of a pair of scissors to facilitate threading, but silk must always be cut square across to avoid unraveling.

Iodoform dusters or other unsterilized articles must be wrapped in sterile gauze.

When the sutures are in sealed glass tubes, the tubes must be sterilized in an antiseptic solution, broken in a sterile towel, and the contents dropped in alcohol.

Ligatures should be about nine inches long and sutures twelve inches.

A complete dressing should be ready in a sterilized towel.

When the intestines are to be exposed hot towels will be needed: to have them ready, sterile water is kept hot and the towels are dipped in when necessary.

Rubber drains usually have a safety pin passed through one end to prevent them from slipping in; gauze-wick drains are prepared by rolling a narrow strip of gauze into a wick about the size of a cigarette and covering it with a layer of rubber tissue.

Instruments should always be handed to the operator with the

handle toward his hand, and in such a position that they may be used at once without loss of time: they should not be allowed to accumulate unnecessarily upon the patient's body, and soiled and bloody instruments should be replaced by clean ones.

Sponging must be done quickly in the intervals of the surgeon's work; the sponge should be used with a firm wiping movement in the direction from the bottom of the wound toward the surface.

Retractors are held in such a position that they and the hands of the assistant may be as little in the way as possible; sharp retractors should be used with care.

In suturing, the needle properly threaded and held in the bite of the forceps should be handed to the surgeon; the assistant then

FIG. 255.—The Interrupted Suture.

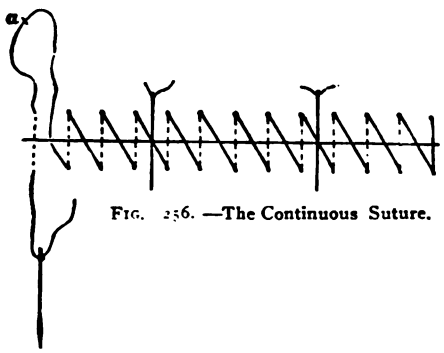

FIG. 256.—The Continuous Suture.

holds the edges of the wound in the proper position for suturing, and is ready with scissors to divide the sutures at the proper time.

When there is no surgeon present with the troops and none is available, the senior noncommissioned officer of the hospital corps detachment must himself undertake necessary minor operations.

Wounds. Clean, incised wounds, the edges of which can not be brought together by the dressing and bandage, should be sutured or sewed up. Silkworm gut, silk, or catgut may be used, the preference being in the order named; sutures of the first two materials must be taken out after four or five days; catgut will be absorbed.

Sutures may be interrupted or continuous. In the interrupted suture (Fig. 255) the needle is passed through the skin and subcutaneous tissues about an eighth of an inch from the edge of the wound, and then tied with a reef knot; care should be taken not to draw the suture tight enough to contract and pucker the skin; the

remaining sutures are then placed about a quarter of an inch apart. The interrupted suture is the one ordinarily used.

The *continuous suture* (Fig. 256) is applied by continuously passing the needle through the skin without cutting the thread.

If there is any doubt about the cleanliness of the wound or if there is much oozing from it, the lower angle should be left open for drainage.

If the wound is in a hairy part the hair must be clipped close, and the skin about the wound painted with tincture of iodine. The same precautions as to instruments and the hands are observed as in operation wounds. If the wound is small and not infected, all the dressing needed may be a few shreds of cotton sprinkled with iodoform and held in place by collodion.

Should the wound contain dirt or other foreign bodies they should be washed away with sterile water or removed with sterile forceps; as such wounds are sure to be infected a free opening must be left for drainage.

Contused or lacerated wounds, unless the contusion is very severe, should be also be sutured, but not so closely as incised wounds nor should the sutures be made so tight, as much tension and swelling are apt to ensue.

Before any wound is sutured all bleeding should be controlled permanently; if the bleeding is capillary this may be done by exposure to the air, hot water, or pressure; if the hemorrhage is from an artery the spurting point must be found, seized with a pair of artery forceps and twisted, or a catgut ligature may be slipped over the forceps and the vessel tied.

In *furuncle or boil* there is a hard painful swelling with a central pustule overlying a small slough or *core.* The occurrence of a number of boils in the same neighborhood is usually due to infection from the first one.

If a boil is seen early enough it may sometimes be aborted by dipping a sharpened stick in pure phenol and carrying it down into the core through the central pustule. If seen later the only thing which will give prompt relief is a free cross cut; the cuts must be deep enough and long enough to go entirely through the hardened part, otherwise they will fail. Use a very sharp scalpel and make each cut at one quick sharp stroke. Local anesthesia may be used. After the incision apply wet antiseptic dressings.

To prevent a succession of boils the skin about the first one should be kept thoroughly clean and disinfected, the hands should be disinfected, and the underclothing frequently changed.

Carbuncles differ from furuncles in being more extensive and sever and in having several openings or *heads;* the treatment is the same.

Felon is an abscess below the fascia or periosteum in the end of the finger; it is due to infection through a hang-nail or some small wound. The tendency is to spread deeply and not to come to the surface. The pain is intense and throbbing. The treatment consists in making a free incision down to the bone and gives prompt relief; unless this is done necrosis of the bone may result. Apply a wet dressing.

Abscesses when near the surface may be detected by the soft fluctuating center surrounded by a hard ring. They should be opened with a sharp-pointed curved bistoury thrust through the skin over the top of the abscess and cutting from within outward. After opening, a drainage tube should be inserted and a wet dressing applied; the drainage tube may be left in as long as pus continues to flow.

Alveolar abscess or gum boil is an abscess starting at the root of the teeth and usually making its way out at the junction of the cheek and gum. The symptoms are toothache, pain, and often great swelling of the face; on opening the mouth pressure on successive teeth will show by the pain produced which one is affected, and often swelling may be seen at the base of the gum. With a straight bistoury a puncture should be made straight downward at the base of the gum and over the softest point.

Ulcers are what are commonly called *sores.* They require wet antiseptic dressings and often the support of a rubber bandage.

An *inflammed hemorrhoid or pile* is an extremely painful affection which may be promptly relieved by a very simple operation. The patient complains of a painful swelling at the anus, and on examination a red or purple, hard swelling is found; this is due to the formation of a blood-clot in the pile. With or without cocaine anesthesia run a sharp curved bistoury through the base of the tumor and cut from within outward; this frees the clot and the pain now ceases.

CHAPTER III

MINOR OPERATIONS, CONTINUED

Subcutaneus saline infusions are frequently given in hospitals for shock, hemorrhage, supression of urine, and other conditions. The appliances needed are a graduated infusion bottle or a fountain syringe, a large-size aspirating needle, and sterile *normal saline solution* at a temperature of 105° to 110° Fahrenheit. In the absence of an infusion bottle or fountain syringe a large funnel may be used; a piece of glass tubing inserted in the length of the rubber tubing will enable the operator to observe the flow of the infusion. All the appliances must be clean and freshly sterilized by boiling.

The bottle or other container is hung up at a height of about three feet above the patient's body, and while the solution is flowing from the needle it is thrust quickly into the subcutaneous tissues and held there (Fig. 257).

The part selected is usually the back between the shoulders, the axilla, or the buttock. The hands of the operator and the site of the operation are carefully disinfected in the usual manner.

The amount injected is usually one or two pints distributed in two or three places; it will require about half an hour for the fluid to enter and during this time the temperature of the solution must be maintained.

After the withdrawal of the needle the skin of the puncture is pinched up, dried with a gauze sponge, and dabbed with collodion; a small gauze dressing is then applied.

Rectal continuous saline infusions by the drop method have replaced to a large extent the subcutaneous infusions. Any ordinary irrigating apparatus may be used with a special nozzle and cut-off.

Intravenous saline infusions are done when quick action is required.

The median basilic or median cephalic vein at the bend of the

elbow is exposed by a short incision, after which an aspirating needle may be inserted direct or the vein opened and a canula tied in; when a needle is used the preliminary incision is usually small. The danger is the introduction of air or any foreign body into the vein which might cause embolism or death.

Intravenous injections of *salvarsan* and *neosalvarsan* for syphilis are given in the same way as saline infusions with the use of needle instead of canula. The injection tube and needle should be filled with salt solution before the prepared solution is poured into the reservoir, so that salt solution only will escape into the tissues if the

FIG. 257.—Subcutaneous Saline Injection.

vein is missed on the first trial. In most cases it is unnecessary to expose a vein by incision.

Injections of antitoxin for diphtheria are usually given between the shoulders; the procedure is the same as for hypodermic injections, the syringe used being of the same type, only much larger. The usual antiseptic precautions are observed.

Syphilis is now usually treated by intravenous injections of *salvarsan*. Mercury is often used in conjunction with the salvarsan and preferably by subcutaneous injections of *metallic mercury* in the

form of "gray oil." The appliances needed are a hypodermic syringe with a large caliber needle, the gray oil, an alcohol lamp, and collodion, or adhesive plaster.

The injections are usually made in a vertical line on either side of the spinal column and about an inch and a half from it and an inch and a half apart. The syringe used should preferably be of a half or one Cc. capacity, and graduated in fiftieths of a cubic centimeter.

The needles should screw on, as friction needles are forced off by the pressure necessary to push out the thick preparation of mercury. After the preliminary sterilization the syringe and needles are kept immersed in a wide-mouth bottle of liquid petrolatum. The gray oil is kept in a wide-mouth bottle of about fifteen Cc. capacity, and the bottle is protected from dust and dirt in a tin box; the box is kept in a cool place, preferably on ice.

The skin of the patient and the hands of the operator having been disinfected, the gray oil is warmed over the alcohol lamp until it will just flow freely, and then drawn into the syringe. The syringe is next turned point up, and the piston compressed until a drop of gray oil emerges; the set-screw of the piston rod is so placed that the syringe can only deliver the required dose, usually 0.05 Cc.; a fold of skin is pinched up vertically between the thumb and finger, the needle plunged in obliquely, and the dose is given. The puncture is compressed by the finger for a moment and then sealed with collodion or adhesive plaster. No rubbing of the spot is necessary or desirable. A ten-per-cent suspension of basic salicylate of mercury in liquid petrolatum is frequently used instead of gray oil.

Acupuncture is the process of puncturing the skin and cellular tissues with hypodermic or other needles for the relief of oedema.

The skin and needles are sterilized, and the former protected with gauze while the fluid is draining.

Aspiration consist in the withdrawal of fluid from a cavity which may be the abdomen, thorax, or pericardium.

Aspiration of the abdomen or *paracentesis* is usually done with a trocar and canula; after preparation as for any surgical operation, make a small incision in the skin and insert the trocar and canula.

Aspiration of the chest is required by an accumulation of serum therein known as *hydrothorax,* or if purulent *empyema;* it is done with an aspirator.

For *aspiration of the pericardium* an exploring syringe or hypodermic is used.

Lumbar puncture is done for purposes of diagnosis or to relieve pressure in the spinal canal. The patient is brought to the edge of the bed with his knees well drawn up and his head and shoulders well bent forward to separate the vertebrae. The puncture is usually made between the fourth and fifth lumbar.

FIG. 258.—Washing Out the Stomach. First step

FIG. 259.—Washing Out the Stomach. Second step.

Blood specimens are frequently required for (1) microscopical examination, (2) Haemoglobin estimates, (3) counts, and (4) cultures.

For (1) and (2) a drop is taken from a needle puncture of the lobe of ear; for microscopical examination it is collected on a clean cover glass.

For counts the blood is also taken from the ear-lobe, but with a special instrument known as the haemocytometer.

For blood cultures about 10 Cc. must be taken from the median basilic vein at the head of the elbow. After the usual surgical precautions, a ligature is bound about the arm above the elbow tight enough to cause the veins to swell up but not tight enough to stop

the pulse; the hypodermic needle is then pushed directly into the vein.

The *stomach tube* is used to remove poisons from the stomach, to wash it out, and to introduce food-gavage.

For the first-named purpose a tube about five feet long is required, for the last purpose one two and a half feet long will suffice. The tube is usually lengthened by a piece of rubber tubing connected by a glass tube.

The patient sits in a chair with his head thrown back; the tube having been warmed and dipped in glycerin is passed, together

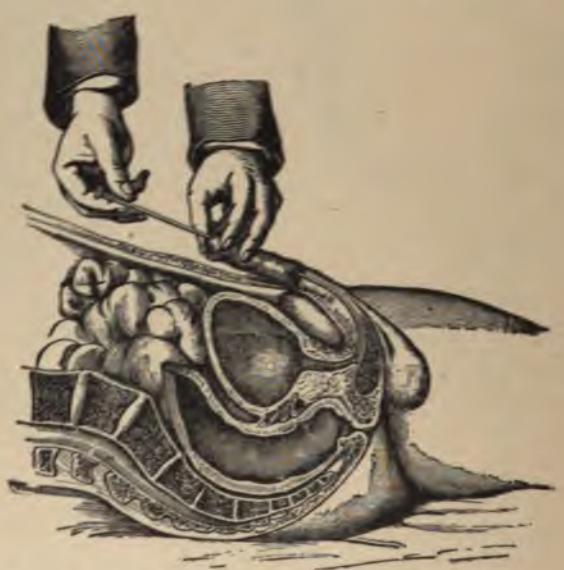

FIG. 260.—Introduction of Metallic Catheter. First step.

with the operator's left forefinger, into the back of the throat: the finger guides the tube past the epiglottis to the back of the pharynx, whence it is pushed slowly and gently into the stomach, its passage being aided by attempts to swallow.

Sometimes the patient prefers to take the tube into his mouth, swallow the end and then push it down himself.

Food is introduced through a funnel in the end of the tube. To remove poisons or wash out the stomach, siphonage must be

secured; to do this pour water into the funnel held above the patient's head until the tube and funnel are full; then before all the water has run out of the funnel lower it below the level of the stomach; this movement may be repeated as often as necessary (Figs. 258 and 259).

When the patient is unconscious the operator must be sure before he introduces any fluid that the tube has not entered the patient's larynx.

Sometimes it is desired to obtain a sample of the stomach contents without admixture with water. To do this, introduce the stomach

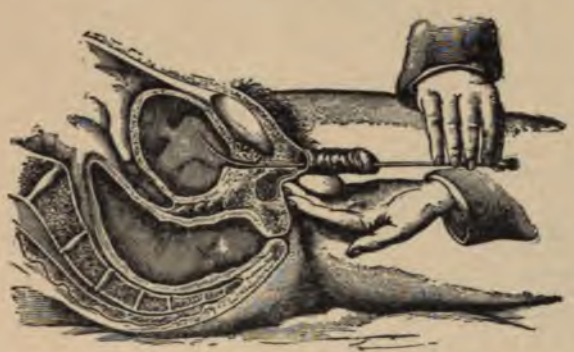

FIG. 261.—Introduction of Metallic Catheter. Second step.

tube in the manner just described, lower the funnel over the basin, have the patient lean forward and strain a little, then gently press the stomach to express the contents.

In *forced feeding*, when the patient resists, it is better to pass a smaller tube along the floor of the nose and thence into the pharynx.

To introduce a metallic catheter or sound into the bladder, place the patient on his back with the shoulders raised, and the legs drawn up and rotated slightly outward so as to relax the abdominal muscles; having sterilized, warmed, and lubricated the instrument, stand on the left side of the patient, grasp the penis in the fingers of the left hand and draw it vertically upward with its back toward the abdomen, hold the catheter lightly in the right hand and introduce the tip into the meatus. The instrument and penis should now be carried close to the body over and parallel with the groin (Fig. 260).

The penis is then drawn up over the instrument which is at the

same time pushed gently in or allowed to pass by its own weight; at the same time the handle of the catheter is slowly carried toward the median line and, after about four or five inches have disappeared in the urethra, elevated to the vertical position, when, the tip passing under the arch of the pubis, the handle is depressed between the thighs (Fig. 261). No force should be used under any circumstances.

Hernia or *rupture* is a condition in which some part of the contents of the abdomen, particularly the intestine, escapes and forms an external tumor. It is usually caused by violent muscular effort or straining, and is especially apt to occur in the tropics as a result of loss of flesh and general muscular relaxation. Though it develops gradually, its appearance is often sudden.

Inguinal hernia appears as a swelling just above the fold of the groin, which may pass on down alongside the testicle, becoming *scrotal*.

In *femoral hernia* the swelling is just below the fold of the groin, and usually much smaller than in the inguinal form.

The swelling is soft and elastic and at first goes back when the patient lies down, or can be pushed back; sometimes it will not go back and is then said to be *irreducible;* if the hernia becomes so tightly caught in the ring through which it passes that the circulation is arrested it is said to be *strangulated*.

The temporary treatment of a hernia consists in the application of a truss. Before the truss is applied, however, the hernia must be put back or *reduced;* if this is not done the truss will press on the delicate intestine and cause severe pain and inflammation.

To reduce a hernia that will not go back of itself, place the patient on his back with a pillow under his hips, and the hips and knees flexed, and tell him to breathe quietly through the mouth, and not to strain. Then grasp the tumor with the fingers and sqeeze it gently as you would a sponge, in a direction upward, backward, and outward; a sudden slip will be felt as the intestine returns. The truss should now be applied with the patient lying down.

A *truss* consists of a pad to cover the ring and inguinal canal, and a spring to make the pressure and hold the pad in place; there is usually also a strap from the end of the spring back to the pad and sometimes also a perineal strap for additional security in large hernias. After a truss is adjusted, its efficiency should be tested by

seeing whether it will hold up the hernia when the patient stands, sits, lies down, bends over, descends stairs, etc.

To measure for a truss place the end of the tape over the point where the hernia escapes, and carry it around the pelvis midway between the anterior superior spine of the ilium and the great trochanter, and back to the starting point.

Toothache: When there is a cavity it should be cleaned out with a little absorbent cotton on the end of a probe or match, and the cavity then plugged with a bit of cotton dipped in phenol, creosote, or oil of cloves.

The tooth should not be extracted unless there is no chance of obtaining the services of a dentist for a considerable time and meanwhile the pain is unbearable.

To extract a tooth see that a forceps is selected which is adapted to the particular tooth; in the sets of forceps furnished the army the particular forceps for each tooth is indicated on a card. Forceps of which the bite has a plain curve on each side are adapted to teeth with a single root, such as the incisors and canines; those of which the bite has a projection on the outer side are for the upper molars, the projections being intended to fit between the outer roots; and those with a projection on both sides are for the lower molars.

The gum should be separated from the neck of the tooth with a lancet, and the forceps pushed down between the gum and the tooth until they reach but do not grasp the border of the alveolus. In order to avoid breaking off the crown, the pressure of the forceps must be only sufficient to keep them from slipping. The tooth is then loosened a little by a rotary motion for the incisors and canines, and an inward and outward rocking motion for the other teeth, and extracted by a steadily increasing pull as nearly as possible in the direction of the axis of the tooth.

The head and jaw of the patient should be steadied by the left arm and fingers of the operator.

Two kinds of *electric batteries* are usually furnished in the army medical department; a *galvanic* or *continuous-current battery,* and a *faradic* or *interrupted-current* apparatus; sometimes the two are combined.

To care for batteries properly it is necessary that their mechanism should be studied. After use the elements or poles should

always be lifted out of the liquid, and care should be taken not to spill the liquid in handling.

With dry-cell batteries it is only necessary to see that the circuit is open when the battery is not in use, but electrodes should be dried or wrapped in some protective before they are put away lest they cause swelling of the box or rusting of the connections.

The essential parts of a galvanic battery are the *cells* which contain the liquid, the *elements* which dip into the liquid, the *cords* which conduct the electricity, and the *electrodes,* usually covered with sponges, through which the electricity is applied; faradic batteries have in addition a *coil* and an *interrupter.*

The sponges should be well moistened with water before use.

To exercise muscles in paralysis the faradic current is usually given about ten minutes at a time. One of the moistened sponges is placed at any part of the limb and the other is moved about with a massaging motion; the skin also should be well moistened.

The galvanic current is given as directed by the surgeon.

CHAPTER IV

ADHESIVE PLASTER, STRAPS AND STRAPPING

As many of the uses of adhesive plaster are so important, it is thought best to devote a chapter of minor surgery to a detailed consideration of its various applications.

To hold splints in place, especially in the upper extremity, it is much superior to bandages, as it allows the fractured parts to be

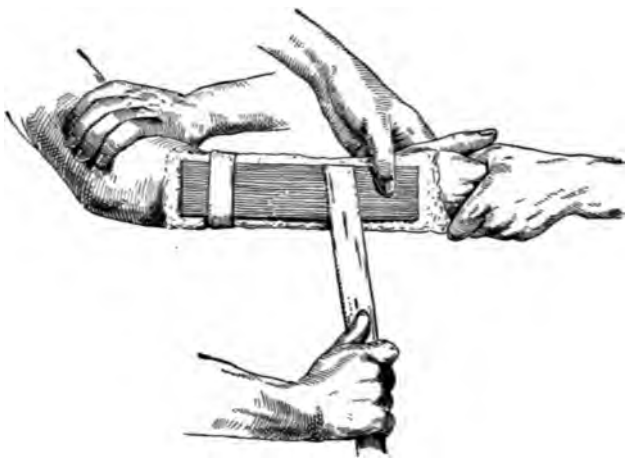

FIG. 262.—Application of Adhesive-Plaster Strips to Retain Splints.

seen; for this purpose two or three strips about an inch wide are used, and applied as shown in Fig. 262.

In the lower extremity webbing straps with buckles are better than adhesive straps to hold the splints in position but the adhesive plaster is used for purposes of *extension in fractures of the thigh.* For this purpose there should be provided two strips of plaster, each two inches wide and long enough to reach from the seat of the fracture to the malleolus; to each strip is sewed a webbing strap of the same width as the plaster and six inches long; three strips, each an inch and a half wide and long enough to encircle the limb,

just above the malleoli, just above the knee, and just below the fracture respectively; and two strips an inch and a half wide, and long enough to encircle the limb spirally from just above the malleoli to just below the fracture. After the limb has been washed, shaved, and dried, the first two straps are applied to the middle of each side of the limb from just below the fracture to the malleoli; then the last two straps are applied spirally in opposite directions to keep the first from slipping, and lastly the three remaining straps are applied in a circular manner as indicated (Fig. 263). A bandage is applied over all.

A spreader of wood, about two inches wide and sufficiently long to clear the malleoli, is attached to the webbing straps; the

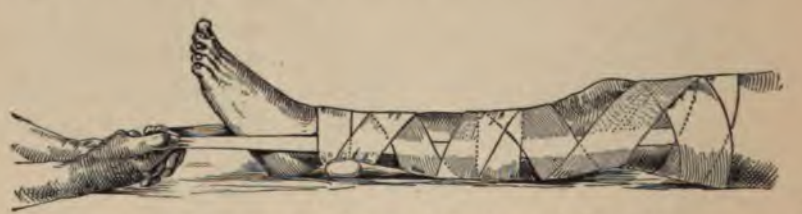

FIG. 263.—Strapping for Extension in Fracture of the Thigh.

spreader has a hole in the middle through which passes a cord which plays over a pulley; to the outer end of the cord is attached a weight.

In *fractures of the ribs* a broad swathe of plaster is used, wide enough to extend about six inches on each side of the fracture and long enough to reach three-fourths of the distance around the chest (Fig. 264).

The patient standing or sitting, with his hands on top of his head, one end of the swathe is fastened just over the spinal column; with the other end in his hands the surgeon walks around the patient applying the swathe smoothly and very firmly. Or strips of plaster about four inches wide may be used, each strip overlapping the previous one about one-third.

In fracture of the clavicle a Sayre dressing (Fig. 265) is especially useful in the field. Prepare three strips of plaster, each three or four inches wide and long enough to go one and one-half times around the body. Encircle the upper arm just above the middle with a strip of bandage wider than the plaster; place a folded towel

in the axilla, and a couple of layers of gauze sprinkled with talcum wherever the skin surfaces would come in contact. Pin a loop of one of the plaster strips, sticky side out, around the upper arm over the bandage; then, while an assistant holds the shoulders back, carry the other end of the strip across the back, under the sound axilla, and over the front of the chest back to the starting point. Now place the hand of the injured side on the sound shoulder; take

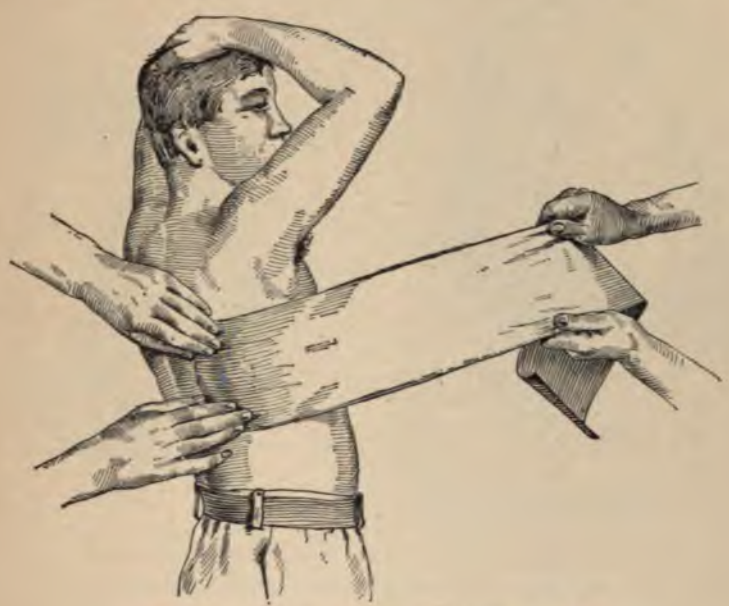

FIG. 264.—Strapping the Chest for Fractured Ribs.

the second strip and, starting at the back of the sound shoulder, carry it obliquely across the back, under the elbow of the injured side, supporting it, and up over the injured forearm and hand to the starting point.

The third strip is carried circularly around the body holding the arm to the side.

Where the second strip crosses the elbow a slit should be made in the strip to secure the elbow, which must here be protected from cutting by the edges of the plaster with a little cotton batting. Over the whole a Velpeau bandage may be applied.

Strapping a sprained ankle has already been fully described, page 90.

A swollen testicle after the acute inflammation has subsided is best treated by strapping. The straps should be a half-inch wide and ten or twelve inches long; the operator isolates the affected testicle by encircling its upper part with the thumb and index fingers

FIG. 265.—Sayre's Strapping for Fracture of Collar-bone. Back view.

FIG. 266.—Strapping the Testicle.

of the left hand, and replacing the encircling fingers with a strap of plaster. He then covers the testicle with a series of recurrent strips, and reënforces the latter by circular strips (Fig. 266).

To bring the edges of a wound together in the absence of sutures, straps of plaster one-fourth to one-half an inch wide may be used. As the plaster is not aseptic the wound itself must be protected from contact with the plaster by a narrow strip of sterile gauze.

To remove plaster straps from a wound, both ends of the strap must be detached simultaneously so as not to tear apart the edges of the wound.

When a good deal of plaster has to be removed, especially if the part is hairy, a little ether or alcohol should be dropped under the edges of the plaster as it is raised; this will cause it to come away without any pulling. Any remaining plaster may be washed off with ether or alcohol, and the skin then dusted with talcum.

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